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The Improved Beaudry Duplex Press.

Since our illustration of this press some time since (April 23), it has been considerably improved, and in its present form is attracting considerable attention at the American Institute Fair, where it is at present in operation forging axes, etc. The machine is made in seven sizes, of which our illustration shows the largest.

As will be seen, the machine is driven by a belt which comes on at the left hand side, driving a shaft which, by a pinion and large spur wheel, drives the main shaft, on which are the eccentrics which operate the plungers.

The sliding heads to which the upper dies or shears are fixed are not attached directly to the plungers, but are only pushed down by them, being raised solely by the action of counter-weights and levers at the back. When the machine is in use, the plungers are working up and down all the time, but they do not impart their motion to the sliding heads until, by the movement of the treadle by the operator, a wedge is pushed in between the end of the plunger and a seat formed for the purpose in the head; the distance to which the wedge is inserted determining the distance to which the die shall descend, thus placing the range of movement of the upper die at all times wholly within the control of the operator.

Under the blocks which hold the lower dies are placed inclined planes or wedges, the positions of which are adjustable by the screws shown in front, and by this means the height of the dies may be adjusted very nicely and in a convenient manner.

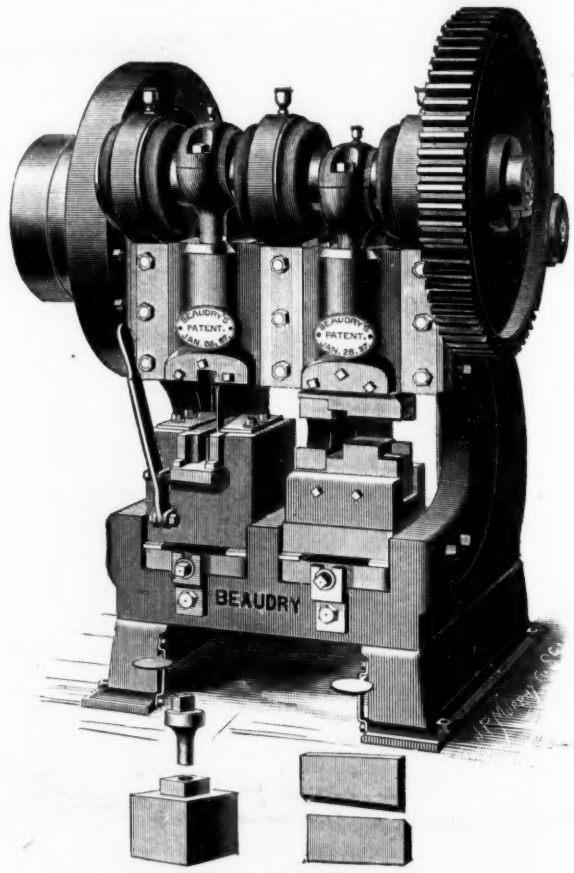
The dies shown in the machine are for forging axes, the breaking down and roughing dies being at the right, and the finishing dies in which the eye is punched at the left. After the punching of the eye the forging is cut from the bar by the shears shown at the left side of the first dies.

It is claimed that in such forging the positive distance to which the dies descend makes the amount of stock placed in the second die so near the right amount to fill it, that the surplus metal can be made to flow back towards the bar, no fin being formed.

The fly-wheel is bored taper and fitted to the shaft without a key, driving entirely by friction, so that if any obstruction should accidentally be placed between the dies, the wheel would slip and loosen the nut which binds it, sufficiently to let the wheel run loose on the shaft.

The machine may be used for cold shearing and punching as well as for forging, the size illustrated being capable of shearing plates $1\frac{1}{4}'' \times 7''$ or $2\frac{1}{2}''$ round bars, and will punch holes $1\frac{1}{2}''$ diameter through $1\frac{1}{4}''$ iron. The fly-wheel weighs 1,250 pounds, and runs at a speed of 230 revolutions per minute. The total weight of the machine is 12,000 pounds.

They are made by Beaudry & Co., 70 Kilby street, Boston, Mass.



IMPROVED BEAUDRY DUPLEX PRESS.

"Cranks" are usually defined as men of a single idea, and men who cover one idea in good shape are generally the ones who accomplish something worth the doing. But no amount of argument will make the crank a popular member of society.

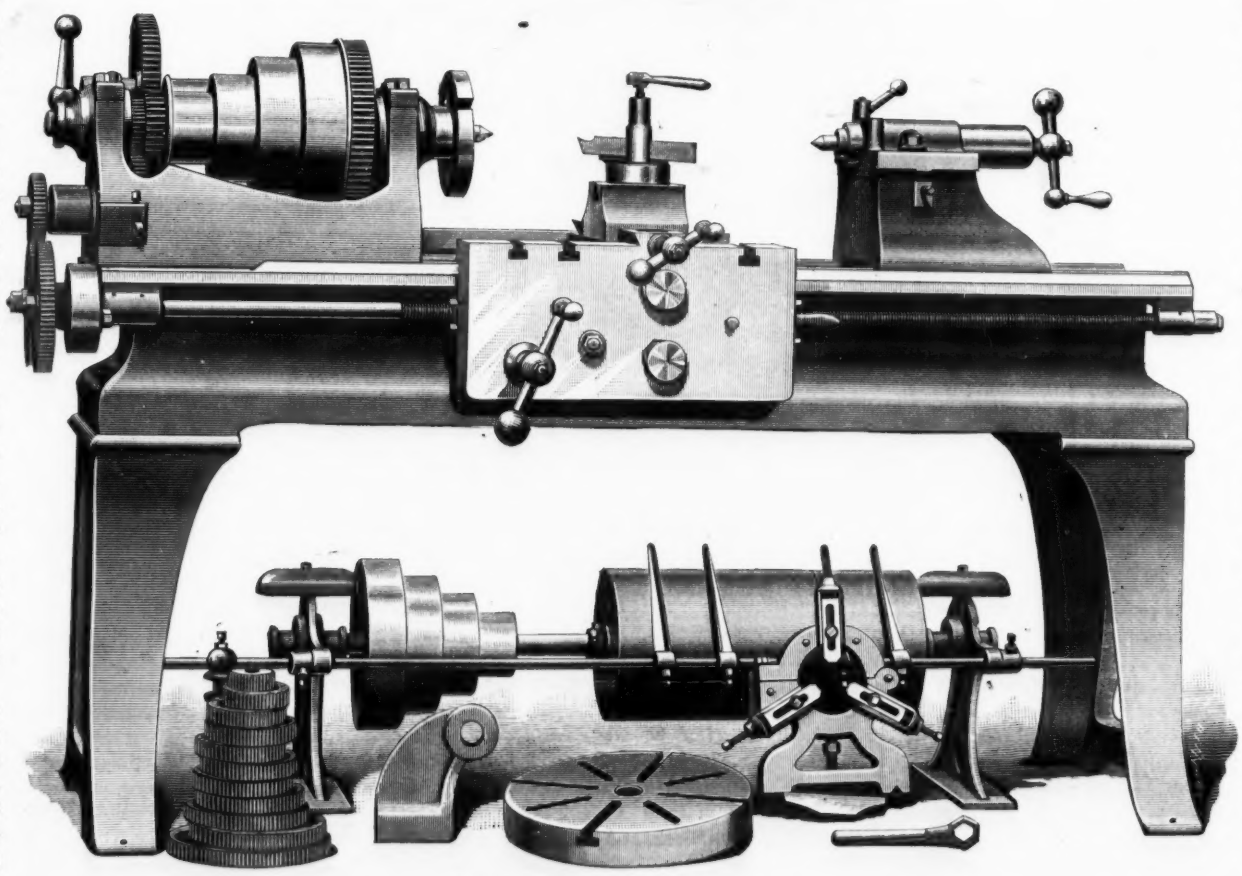
Eighteen Inch Engine Lathe.

We illustrate on this page and on page 2 a new design of 18" engine lathe, by Sebastian May & Co., Cincinnati, Ohio. As will be seen by the cuts, the lathe is plainly and substantially designed, and it is claimed has ample strength for the largest work within its limit of swing.

The boxes are of hard bronze, the spindle and all actuating screws of steel, the bearings being accurately ground. The front bearing of spindle is $2\frac{5}{8}''$ diameter and $4\frac{1}{2}''$ long, and there is a $\frac{3}{4}''$ hole through the spindle. The cone pulley takes a $2\frac{1}{2}''$ belt, its largest diameter being $11\frac{1}{2}''$. The makers state that special care is taken to secure truly cylindrical bearings on the spindle, and that all gears are cut with cutters of the most approved form, by which quiet and steady running is secured.

The sectional views show the general design and proportion of the parts.

A separate gear is furnished for every standard tap thread from 4 to 18, including one for $11\frac{1}{2}$ threads. The lathe has automatic cross feed, and is furnished with all the usual accessories. The counter-shaft has one tight and two loose pulleys, 10" diameter, for a 3" belt, and should run at 130 revolutions per minute. The lathe swings over the rest 11", and with a bed 6 feet long takes 2 ft. 10 in. between centers, and weighs 1,900 lbs.



EIGHTEEN INCH ENGINE LATHE.

Explosion of the "Elba's" Steam Pipe.

On the 19th of Sept. last one of the most frightful disasters that has occurred for a long time took place on board the steamship "Elba" in Stokes Bay, Southampton. The engines and boilers had been overhauled and the vessel was making a trial run over a measured mile, when a copper steam pipe, which conveyed steam from the boilers to the engines, was ruptured longitudinally for a distance of three feet, and the steam, which was at 150 pounds' pressure, escaping into the stoke hole, kept it full of hot steam for two hours, and ten men who were in the stoke hole at the time of the explosion were not only scalded to death, but the bodies of nine of them rendered almost unrecognizable. The section of pipe which burst was 6′ 9″ long, $9\frac{3}{8}''$ inside diameter, and was made of copper $\frac{1}{4}''$ thick. It was new, and it is claimed had stood a hydraulic test of 300 pounds. The rupture took place along the edge of the brazed joint, but not through it.

As is usual in such cases, there were those who felt it incumbent upon them to account for the explosion in some way, and instead of attempting to do so in some

plain and practical way, drew upon their imaginations and invented theories regarding the action of moving water in the pipe, assuming their facts to fit their theory.

The coroner's jury, after an exhaustive inquiry into the matter, extending over a period of nearly a month, has shown its similarity to American juries by returning a verdict of "accidental death," and adding that "they found no evidence of culpable negligence against any person brought before them."

Engineering, in reviewing the matter, points out that some very peculiar computations were made before the jury regarding the tensile strain upon the copper composing the pipe, and by which this strain was made out to be 6.28 times greater than was actually the case.

By such means, and by the theorizing above referred to, the most obvious conclusion to be drawn from all such occurrences—*i. e.*, that the strength of the pipe had in some way been reduced below the point necessary to resist the normal pressure—was covered up and lost sight of, the result being an unsatisfactory and indefinite verdict.

It is of prime importance that the causes leading to such disasters should be definitely ascertained and made known, to the end that they may be avoided, and it is therefore with considerable satisfaction that we credit our contemporary with having pointed out very clearly the real cause of the disaster, viz.: that the copper sheet had been overheated in brazing, and its strength along the line of the joint greatly reduced thereby.

Specimen strips were cut from different parts of the pipe, and their tensile strength tested. The results showed conclusively that the strength of the copper along the line of the joint was much less than elsewhere, the percentage of elongation being in some cases reduced from 25.4 to 7.6 per cent.

To make it more clear, specimens were overheated and then tested, the results showing conclusively that overheating during the brazing process was solely responsible for the calamity.

We consider it fortunate that the accident is thus clearly accounted for upon practical grounds, and to be the result of causes which are avoidable. Such accidents are in themselves bad enough, but if the causes of them are to be buried under impractical theories, and rendered mysterious and incomprehensible, their avoidance will be rendered impossible.

A correspondent, who signs himself M. I M. E., writes thus sensibly to *Industries*, an English publication, in reference to the steam boiler compulsory inspection bill: "It is well known that many steam boiler explosions have been traced to mismanagement arising from the ignorance, neglect or carelessness of the attendant, and yet no provision is made in the bill that boilers should only be placed in the hands of skilled men. I have known many cases where ignorant and unskilled men—in fact, common day laborers—have been made to do the duty of trained men. This arrangement is criminal, and at the same time it is false economy, as a skilled man will get greater duty out of the fuel, burn less of it, and at the same time add much to the longevity of the boiler. If we are to have a compulsory inspection bill, why not make it a tolerably complete one, and compel each boiler attendant to hold a certificate as to his competency to undertake the important duty to which he aspires? This would inflict no hardship on competent men, and add much to public safety. The bill in its present form appears to me to be incomplete and defective, and to require considerable modification before being passed into law."

Proportioning Shop Tools.

BY FRED J. MILLER.

In too many shops, no system whatever is made use of in the proportioning of tools as they are made, one of the distinguishing characteristics of tools made in the shop, instead of being purchased, being their lack of uniform appearance when placed together; each individual tool looking as if its size, shape, and proportions had been determined from considerations applying to that particular tool only, and which, for some inscrutable reason, it would not do to apply to any other tool of its class.

Wrenches, arbors, taps, gauges, etc., are usually made one or two at a time as they may be needed, and are fashioned in accordance with the fancy, whim or convenience, of the blacksmith or the lathesman, the result being that a half-inch wrench may be heavier than the three-quarter one; the three-quarter tap may have much more material in it than the one inch one, while some of the gauges may be so heavy as to be clumsy, and others so light as to be nearly useless. It is much better to make all such tools in conformity to some uniform rule, or proportion, so that even if they be made one at a time, and by different men, yet each tool will have the same proportions as all the rest, and the set, when completed, will have a uniform appearance much more pleasing to the eye of a mechanic than if they were proportioned by chance, and the tools will be better for actual service. A very convenient way of securing uniformity in these matters is shown by the accompanying diagrams.

We will suppose that plug gauges are to be made: the first thing to be done is to decide either by observation of some good model, by a few preliminary sketches or otherwise, what would be the proper proportion and shape of the smallest, and of the largest gauges likely to be required. We will suppose that in this instance the smallest is $\frac{1}{8}''$, and the largest $1\frac{1}{2}''$. Having determined in any way preferred, what the shape and proportions of these two plugs are to be, the next step is to draw the vertical lines any convenient distance from each other, which form the ends of the diagram Fig. 1. The longer line being equal to the length of the $1\frac{1}{2}''$ plug, while the shorter line equals the length of the $\frac{1}{8}''$ plug. Now, plug gauges are likely to be wanted varying by sixteenths of inches all the way between these two sizes. We therefore place twenty-one other vertical lines at equal distances apart and between the two extreme lines.

Each of these lines represents the length of some plug, and the line representing any given sized plug is found by reference to the scale at the bottom. Thus, the third line from the left gives the length of a quarter-inch plug, the next one five-sixteenths, and so on.

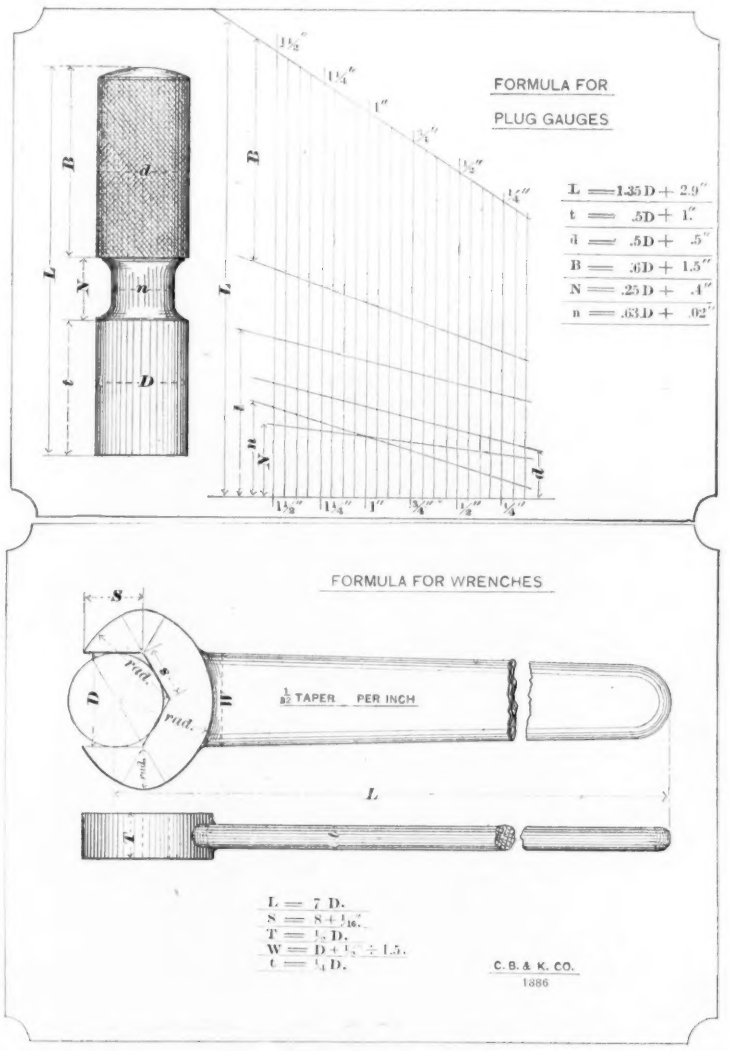
Now, the other dimensions of the two extreme sizes having also been determined, it is only necessary to set off equivalent distances upon the two extreme vertical lines of the diagram, connect the points so determined by straight lines as shown, and we have a diagram from which any dimension of any sized plug may be readily obtained. For instance, suppose a one-inch plug is wanted. Its length is found by measuring the line designated 1″ on the diagram, the diameter of the handle *d*, by measurement from the bottom to the line designated *d*, the length of the neck *N*, by measurement to the line so designated, and so on.

In some constructions the lines determining dimensions will properly be curves instead of straight lines, but the principle is the same. These curves may be plotted by calculating or otherwise determining the proper dimensions of several sizes besides the two extreme ones, laying off the distances so determined upon the corresponding vertical lines, and joining the points so found by a curve.

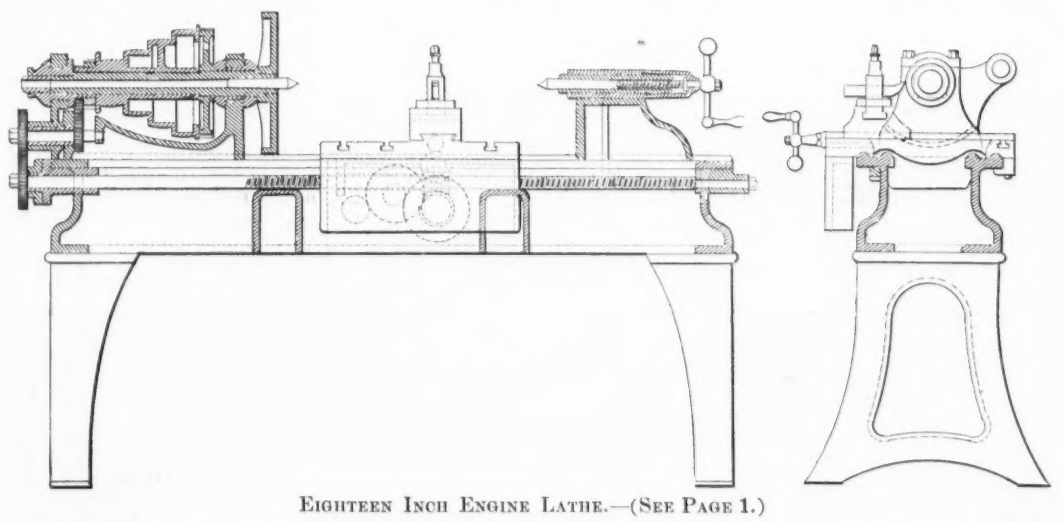
The formula at the right shows what proportion each part bears to the nominal size of the plug, and from it all the dimensions may be determined if preferred.

Fig. 2 shows a similar card for wrenches, but on this the diagram is omitted on account of its size, though of course for the shop one may be constructed and used.

A few such cards, made and mounted upon card board and hung up in the tool room, will be found very convenient, and tools made in accordance with them will look as though they had been designed by some one who had a definite object in view, and not as though they had been evolved by chance or had "just growed."


FORMULA FOR
PLUG GAUGES
L = 1.35 D + 2.9″
t = .5D + 1″
d = .5D + .5″
B = .6D + 1.5″
N = .25 D + .4″
n = .63 D + .02″
FORMULA FOR WRENCHES
TAPER PER INCH
L = 7 D.
S = 8 + 1/16″.
T = ½ D.
W = D + ½ ÷ 1.5.
t = ¼ D.
C. B. & K. CO.
1886

PROPORTIONING SHOP TOOLS.



EIGHTEEN INCH ENGINE LATHE.—(SEE PAGE 1.)

A typographical error in our account of the Eclipse Ice Making and Refrigerating machine made Mr. Penney say that the boiling point of liquid ammonia at atmospheric pressure is 40° F. below, and at 320° F., at the pressure of the atmosphere, one pound of the gas will occupy 21.017 cubic feet. Instead of 320° F. it should have been 32° F.

The will of ex-Senator Hezekiah B. Smith, of Smithville, provides that the income of his estate, valued at $600,000, shall be devoted to the establishment of a free school for the instruction of apprentices to the machinist trade at Smithville. The large machine shops at Smithville, which give employment to two hundred hands, will be kept in operation. The trustees named in the will are: Major A. Jackson Smith, Eayre O. Lippincott, Bradford W. Storey, Charles Chickering, Edward F. Burns, George D. Field, George A. Lippincott, Benjamin Crozier.—*South Jersey Advertiser.*

Mr. John L. McMilan has invented a type-setting and a distributing machine.

The type-setter is operated by a key-board similar to a type-writer, and requires a second man to do the "justifying." It is claimed that 50,000 ems solid have been set in a day. The distributor is claimed to have a capacity of 100,000 ems per day.

The *Engineering and Building Record* favors a law prohibiting the adding of more than a specified number of feet to the walls of a building in process of construction in one day. This, in view of the fact that buildings frequently fail, and the cause of failure can be traced to too rapid work in their erection.

Our English exchanges report a decided improvement in the condition of the shipbuilding industries of the Clyde.

Ormsby's Self-Lubricating Pulley Bearing.

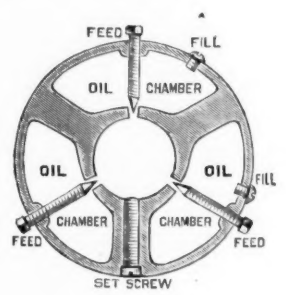
As will be seen by the engravings, this device consists of two principal parts, viz.: a sleeve and an oil supply collar.

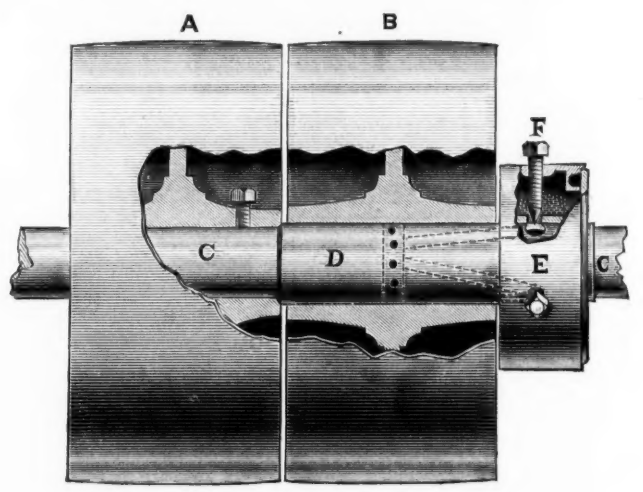
The sleeve is constructed with oil ducts or channels, running diagonally, somewhat in the form of Vs, across its inner surface, next the shaft (as indicated by dotted lines in the larger cut), communicating at one end with the collar and at the other with the center of the pulley hub.

The collar is constructed with three oil chambers, each chamber communicating with one of the V oil ducts in the sleeve, so that, no matter what position the shaft may be in, one of the chambers will be high enough to feed, and from which the oil will have a downward course to the inside of the pulley. Each chamber is provided with a taper-pointed feed screw, by the adjustment of which the flow of oil into the sleeve can be regulated with nicety, graduating the feed, from an occasional drop at long intervals to a constant and most copious flow. Oil, upon leaving the uppermost chamber of the collar, at the point of the feed screw *F*, passes downwards through the duct, under the dotted lines, and is discharged against the wearing surface of the pulley.

When desirable, these sleeves can be applied to old shafts worn by the pulleys, and the worn pulley re-bored to fit the bush.

The manufacturers are The Globe Loose Pulley Co., Covington, Ky.





SELF-LUBRICATING PULLEY BEARING.

Mr. D. K. Clark has made a report on the new patent furnace of Messrs. Ashworth & Kneen, of Dalton-in-Furness, in which he states that the evaporative efficiency, with ordinary slack, during a whole day, amounted to nearly 11 pounds of water per pound of fuel. With good coal as much as 12 pounds of water have been evaporated. The Ashworth & Kneen furnace is specially designed to effect the rapid and complete intermixture of the combustible gases, which pass from the ordinary furnaces, with a supply of heated air for the purpose of effecting their complete combustion and the entire prevention of smoke. Mr. D. K. Clark says a high temperature is kept up behind the bridge by means of zigzag checkerwork, and oxygen in the atmosphere is conveyed, without passing through the glowing carbon on the bars, in a thoroughly mixed and uniform condition, to the gas when thus intensely hot, the result being perfect combustion, even in the case of ordinary coal.—*English Mechanic.*

Safety Valves for High Pressure Boilers.

BY W. H. BOOTH.

There is a quite natural tendency, even amongst engineers who ought to be better posted, that a boiler carrying high pressure steam should have a larger area of safety valve opening than is proper to a boiler worked at a low pressure. A little thought will soon convince anyone holding such views that they are entirely erroneous. It is well known that the total heat of steam at any pressure varies little from that at any other pressure. Thus, a reference to any table of the properties of steam will show that to raise steam of about 30 pounds' gauge pressure requires a total heat of evaporation of about 900 units, as against 912 units for a pressure of about 90 pounds by the guage. Practically, then, it may be said that the same boiler will, per pound of fuel, raise the same weight of steam, whatever may be the working pressure. Any difference is in favor of the low pressure boiler and against our argument. We may therefore take the statement as a fact, seeing that the slight alteration necessary to make it so would only strengthen the argument, which is that there is not the same necessity for large safety valves in high pressure as in low pressure boilers, and some little study of the question of safety valves generally may not be out of place to throw light upon certain facts too often overlooked. The old British Board of Trade rule for safety valve area is half a square inch per square foot of fire grate area. We do not know if this rule still stands good, but think it very probable that it does so, as the British Board of Trade is not especially noted for its facility in imbibing new ideas. The absurdity of such a rule is very apparent, for the same safety valve area would by it be allowed to any boiler, whatever its pressure, though it has been long known that such is unnecessary and leads to clumsiness where high pressure is concerned. In the year 1874 a committee was appointed in Britain, by, we believe, the shipbuilders of Scotland, to investigate the question of safety valve discharge. This committee did some very useful work in investigating the amount of the flow of steam from orifices.

In its report the committee gives as a rule for calculating the velocity of flow of steam in feet per second as 3.5953 times the square root of a certain quantity, which is abstract in idea only and is the height in feet of a column of steam of equal density throughout and of the pressure for which the velocity is required. Thus, at a pressure of 30 pounds above the vacuum line (or 30 pounds absolute), it would be found that a column of steam of the density corresponding to 30 pounds' pressure would be 58,144 feet or simply 697,728 cubic inches of steam would weigh 30 pounds. Those of our readers who have a table of logarithms handy, can always find this height by means of it; for the logarithm of the height in feet of the column of uniform density is 4.67735 + .059 log: p, where p is the pressure given. It is, however, more to our purpose to call fresh attention to the results of the committee's work, and we reproduce the following table from the report. In the first column are given the square inch pressures. In the second column, the equivalent height of column = h. The third column gives the velocity of flow per second in feet, whilst the next two columns give the amounts of steam found to flow through ordinary square and round-edged orifices, similar to safety valve openings. The column marked $\frac{3}{4}$ P is simply a column of figures three-fourths of the figures in the first or pressure column, and is important and useful, as will be seen further on.

P = Absolute pressure of steam per square inch.	h = corresponding column height of density equivalent to P.	V = velocity of flow in feet per second.	Weight of steam escaping at one square inch of round-edged orifice = W.	Ditto through a square-edged orifice of one square inch area.	$P \times \frac{3}{4}$
25·37	57,570	863	22.81	19 60	19
30	58,144	867	26.84	23.00	22 5
40	59.138	874	35.48	30.50	30
45	59,550	877	39.78	34 20	33.8
50	59,922	881	44.06	37.70	37.5
60	60,570	885	52.59	45.20	45
70	61,123	889	61 07	52.50	52.5
80	61.372	891	65.30	56.10	56.5
90	62.036	895	77.94	67 00	67.5
100	62,423	898	86.34	74.30	75

The actual velocity of efflux is really greater than that given in the column 3, but this is because the steam as it escapes really begins to expand before it is actually out, and the true velocity is 1.624 times that given. The figures in the column are, however, correct on the assumption that the steam preserves its density and no error arises from neglect of the fact that a greater volume issues of proportionately less density and higher velocity.

A singular coincidence is observable between the columns five and six, and so remarkable and close is this that the committee felt justified in propounding the rule that for any pressure not less than 25 37 lbs. absolute, the weight of steam escaping per minute at an orifice of a square inch area was three-fourths the pressure. Thus at 40 pounds absolute pressure there is a flow per minute of 30 pounds of steam per square inch of area of a square-edged opening, such as a safety valve may be assumed to be. This is well worth bearing in mind, as it affords so ready a means of calculation.

The table shows us that three square inches will discharge 69 pounds weight of steam per minute from a 30 lb. absolute boiler, and that one square inch will discharge 67 pounds from a 90 lb. boiler. Now the heat necessary to raise 67 pounds of water from a temperature of 100° to 90 pounds pressure is only (1⅞) one per cent. less than the amount required to generate 69 pounds weight of steam at 30 lb. Hence there is an almost absolute equality between three square inches of opening for 30 lb. steam and one square inch for the high pressure of 90 lb. Hence may be laid down the rule that the area of safety valve opening required is inversely as the absolute pressure. We may now seek for a good method of finding the requisite valve area for any given boiler, and this pre-supposes a knowledge of the rate of combustion, which varies, of course, with the service the boiler may be called on to perform. For a stationary boiler with an ordinary draft a consumption of 20 pounds of water per foot of grate surface is a common maximum, and though higher rates of 21 to 25 are met with, 20 may be taken as a sufficient amount, and each pound of coal may be calculated to give a duty of nine pounds of water. More is sometimes done, but less is commoner practice, and therefore an evaporation of 180 pounds of water for each square foot of grate area is fully as much as need be counted upon, or three pounds of water per minute. Now the weight of steam per minute passing through a square is ¾ of the pressure or $\frac{3P}{4}$; therefore to discharge a pound weight per minute of steam of the pressure P an area would be required equal to $\frac{4}{3P}$. In other words, to find the area necessary to discharge one pound per minute, multiply the pressure by three, and divide four by the product. But a square foot of grate produces three pounds per minute, and therefore to discharge the product of a square foot of grate area requires just three times $\frac{4}{3P}$ or simply $\frac{4}{P}$. Hence to find the actual safety valve area of any boiler, multiply the fire grate area by four and divide by the absolute intended blowing off pressure. The result is the area of safety valve in square inches for a stationary boiler of ordinary description. For pressed boilers, such as marine boilers with forced draft, or locomotives, the consumption of coal per foot of grate is higher and may amount to 150 pounds per square foot per hour, but in this connection it should not be overlooked that such an evaporation as this only takes place when the steam blast is on and the engine therefore at work and using steam. It is not therefore necessary in a locomotive to calculate safety valve areas from the maximum rate of combustion, for it is probable that when the engine ceases to use the steam, the rate of combustion falls to nearly that of the stationary boiler, though the possible running down grade, with forward ash pan damper open and rear damper shut, may occasionally produce a pretty high rate of combustion when no steam is being used. Expressed as a formula, then the foregoing rule may be written $A = \frac{4\ G}{P}$ when A is area of valve in square inches, and G the grate area in square feet, and that for locomotives, the area may be about doubled, on the assumption of a possible rate of combustion of 40 pounds per foot. Now it should be distinctly understood that by area of safety valve the area of the circle of the valve seat is not meant, for no valve, unless of special construction, gives an area of discharge equal to its nominal area, because the lift of valve necessary to give such an area would be a fourth of the diameter.

Experiment shows that safety valves cannot be figured upon as lifting more than $\frac{1}{28}$th part of their diameter. Thus a 3½" valve has only a lift of $\frac{1}{10}$th inch. By this reason, then, and the fact that the circumferences of circles are simply proportionate to their diameters, it comes about that several small valves are better than one large one, for in place of a 4 inch valve requiring, say, a lever weight of 50 pounds, we might substitute four 2 inch valves very much handier, and carrying only 12½ pounds each, or even less, by reason of the power of reducing the fulcrum distance by 1 inch.

When special designs of valve are employed or contemplated, it will be remembered that the maximum lift should be one-fourth of the diameter, for the area of outlet thus afforded is then equal to the area of the valve circle.

Now, with the ordinary lift of $\frac{1}{28}$th in place of $\frac{1}{4}$th, it will be necessary to employ valves having 9 times the area found by our rule, or the area of valve circle will be $\frac{36\ G}{P}$. Expressed in terms of the diameter, we have simply $D = 6.8\sqrt{\frac{G}{P}}$

Placed in the form of a rule, we may now finally state that to find the proper diameter of safety valve for ordinary stationary boilers: Divide the grate surface by the pressure in pounds and take out the square root of the quotient; multiply this by 7 and the result is the diameter in inches. Thus as an example. Given a boiler of 30 square feet grate area, working at 80 pounds' gauge pressure. We have 80+15 = absolute pressure = 95. Then $\frac{30}{95} = .316$. The square root of .316 is .56, and .56 × 7 = 3.92 inches. We should therefore employ a four inch valve at the very outside, and as practice demands two valves per boiler, we should probably employ a pair of 3½ inch valves; certainly not less than this.

Foundry Ladles.

BY L. C. JEWETT.

The writer in his travels has been shopmated and gained experience with every conceivable kind of ladles, ranging from the fair proportioned ones to those of the grotesque and the absurd. It is generally conceded that the surroundings of a workman and the tools with which he is furnished will influence his ability as a mechanic, his self-respect as a man, and his regular attendance in the place of his employment. Therefore all shops should be equipped with good proportioned tools, provided with good light and ventilation, and the general arrangement of the shop should be such that will promote comfort as much as possible, so that it will be a pleasure for the workmen to enter it and attend to their duties.

Workmen who have had to use badly proportioned tools, and had to work in the worst arranged shops, know the feeling of reluctance in going to their place of business; moulders, too, have experienced the same feeling, and particularly will they have this feeling of reluctance when the foundry in which they are engaged is equipped with badly proportioned ladles. No one will assert that the moulder's interest and pleasure in his work will be increased by being compelled, when his work has to be poured, to carry a ladle out of balance, or with shanks so proportioned that the ladle is hard to carry, frequently having to carry or support with one hand three-quarters of the load, throwing the spine into a curve or out of perpendicular.

Every foundryman knows that the boys will soon find the best balanced ladle, and in order to secure its use, any kind of scheming will be resorted to, and the poorly balanced ladle left alone or avoided as much as possible. There can be no doubt in the statement that good ladles have an influence in keeping moulders steady and temperate. The writer is reminded of the following circumstance in his experience:

When, in the shop where he had just started to work, his first cast was to be made, he inquired for the single hand ladle; the foreman, after a prolonged search, brought forth a round bottomed cast iron pot, which had been in service as a hand-ladle for about two years. This pot, when filled, would hold about 75 pounds, and the foreman said, "You are not obliged to fill it." This so-called ladle was not filled by the writer, neither did he remain to see another heat in that foundry.

After duly considering the want of something as a standard for foundry ladles, the writer offers the accompanying table of dimensions, and the forms given in Fig. 5, as standard sizes and forms of ladles. From this table, and the nest of ladles shown in Fig. 5, can be selected a suitable size of ladle for a capacity from 38 pounds to 20,000 pounds; and it is believed that this wide range of capacity contains all different sized ladles which may be needed, in the average foundry at least. The weights and capacity here given are for lined-up ladles; of course, the capacity will depend upon the thickness of the lining; but when ladles are lined up as they should be, the capacities here given can be accepted as reliable and correct.

The proportions and sizes given in the table for the shanks suitable for ladles of the different capacities, as shown in Fig. 5, have been obtained by careful calculation; and shanks having these dimensions will possess the lightness compatible with the necessary strength and general fitness of things. In regard to the dimensions given in column C, it may be said, that for ladles up to 2,500 pounds capacity, the dimensions given in this column should be used; but the diameter of the shanks for ladles of larger capacity can be reduced through a portion of their lengths.

Take, for instance, the shank for a 20,000 pound ladle; according to column C, this shank should be 30 inches long and $3\frac{3}{4}$ inches in diameter. Now it is not necessary to make the entire length (30 inches) $3\frac{3}{4}$ inches in diameter, but only that portion of the shank which is attached to *E* and connects the sling and bottom strap needs to be $3\frac{3}{4}$ inches in diameter; the remaining length can be made 2 inches in diameter with perfect safety. Yet it may be remarked that ladles of this size are invariably handled by cranes, and a few pounds more or less of metal in the shank where it is not absolutely needed will not materially interfere with the convenient manipulation of the ladle.

For a good geared ladle of 11,000 pounds capacity, the writer recommends the design given and described in the AMERICAN MACHINIST, page 2, December 16, 1882.

Figs. 3 and 4 represent a 4,000 pound ladle made straight. The object of showing it is merely to give the proportions of such a ladle to parties who want but one ladle of this size. The straight ladle possesses an advantage, namely, the amount of fluid iron which it contains can be easily ascertained. The foundryman measures the depth of the fluid by putting a rod into it, and then, knowing the amount of fluid contained in one inch of depth, the total amount in ladle is quickly known.

The 10,000, 16,000 and 20,000 pound ladles should have fire-brick bottoms, as shown in the nest of ladles, Fig. 5. The side of these ladles should be made of iron $\frac{1}{4}$ of an inch thick, and the iron for the bottom should be $\frac{1}{2}$ of an inch thick. The 6,000 and 4,000 pound ladles should have sides 3-16 or $\frac{1}{5}$ of an inch, and the bottom $\frac{3}{8}$ or $\frac{1}{4}$ of an inch thick. For the 300 to 2,500 pound ladles, sides 3-32, 3-16, or $\frac{1}{8}$ of an inch thick, and the bottom $\frac{1}{4}$ of an inch thick, will be suitable. The writer makes the 38 to 200 pound ladles of cast-iron, the bottoms $\frac{1}{8}$ to $\frac{1}{4}$ of an inch thick, the sides 3-16 of an inch at the bottom and tapering to $\frac{1}{8}$ of an inch at the top. Generally the sides of the 38 pound ladle are made as thin as possible, with bottoms $\frac{1}{8}$ of an inch thick.

Fig. 6 represents the ladle shanks, the dimensions of which are given in the table. Fig. 7 represents the so-called single hand shank. The dimensions of this shank in the illustration are those which the writer found to give the best satisfaction, or which will suit the greatest number of foundrymen. This particular thing, I suppose, has more whims to contend with than any other thing in the foundry; many moulders will insist on having the handle stand a little higher or lower or made longer; but the writer has noticed that when this shank is made as shown, fewer complaints are made than when any other form of single hand shanks are used.

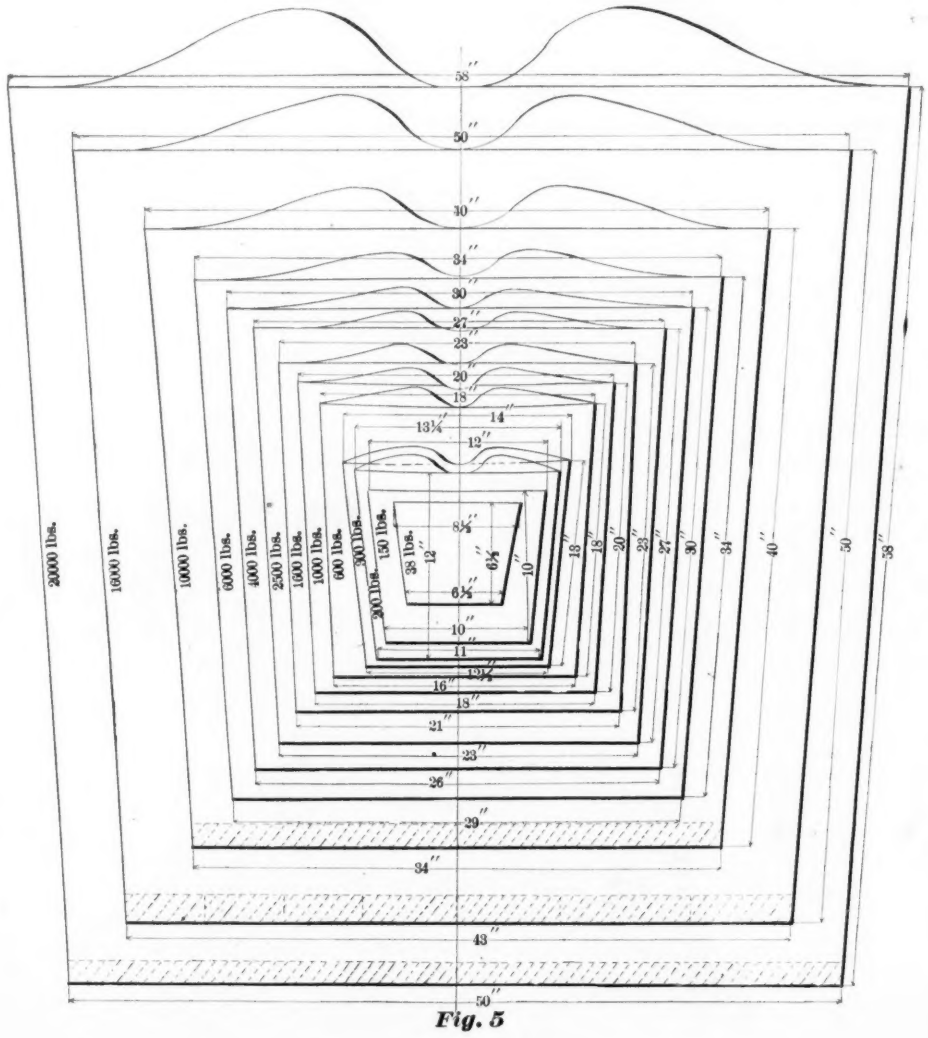


Fig. 5

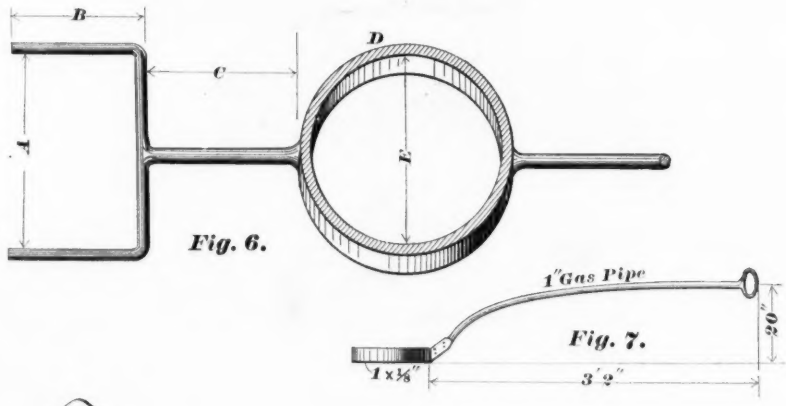


Fig. 6.

Fig. 7.

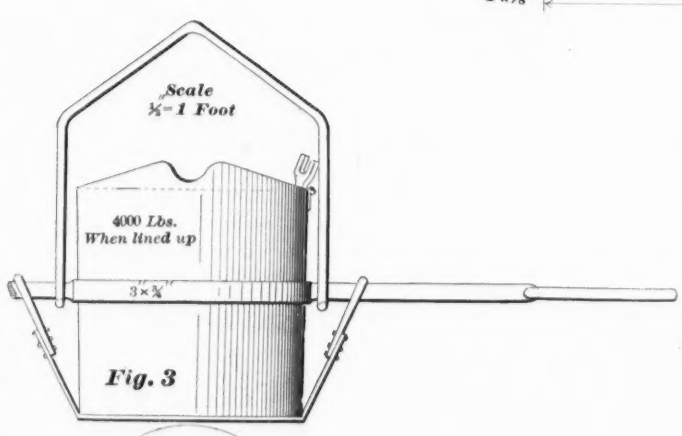


Fig. 3

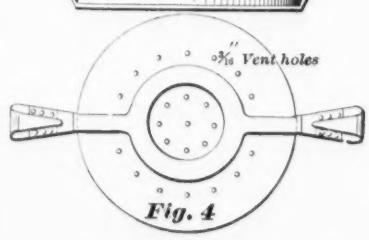


Fig. 4

Capacity in lbs.	Between Handles A	Length & size of Handles B	Length & size of Shank C	Width & thickness of Bail D	Dia. of Shell E
150	20"	12" x ⅜"	18" x 1¼"	2¼" x ⅜"	11" & 10⅜"
200	20"	16" x 1"	18" x 1½"	2¼" x ½"	12½" & 11⅜"
300	20"	16" x 1"	21" x 1½"	2½" x ½"	13¼" & 13"
600	24"	16" x 1"	24" x 1¾"	2⅝" x ½"	17" & 16⅜"
1000	24"	16" x 1½"	24" x 1¾"	2⅝" x ⅝"	19" & 18⅜"
1600	24"	16" x 1⅝"	26" x 1⅞"	2⅝" x ⅝"	22" & 21 11/16"
2500	26"	20" x 1¼"	26" x 2"	3" x ⅝"	25" & 24½"
4000	26"	20" x 1½"	28" x 2¼"	3" x ¾"	28" & 27½"
6000	26"	20" x 1½"	28" x 2½"	3½" x 1"	31½" & 30¾"
10000	26"	24" x 1¾"	30" x 3"	4½" x 1"	37" & 35¼"
16000	28"	24" x 1¾"	30" x 3½"	5½" x 1¼"	46½" & 45⅝"
20000	30"	24" x 2"	30" x 3¾"	6½" x 1⅝"	54" & 53"

FOUNDRY LADLES.

Fall Meeting of Mechanical Engineers.

As intimated in a previous issue, the business sessions of the Mechanical Engineers will be held at the Continental Hotel, Philadelphia, beginning Monday evening, Nov. 28. On Monday evening the president will deliver the annual address. Tuesday there will be a session in the morning and another in the evening, the afternoon being left free for members to visit manufacturing establishments. The following firms have extended invitations:

Bethlehem Iron Co., Bethlehem.
Lehigh Zinc and Iron Co., Bethlehem.
Pennsylvania Steel Co., Steelton.
Henry Disston & Sons, Tacony.
Baldwin Locomotive Works, City.
Bement, Miles & Co., City.
Wm. Cramp & Sons, Ship and Engine Building Co., City.
I. P. Morris & Co., City.
Wm. Sellers & Co., City.
Southwark Foundry and Machine Co., City.
Williamson Bros., City.
Kensington Engine Works, City.
Otto Gas Engine Works, City.
Pennsylvania Museum and School of Industrial Art, City.

Wednesday there will be a session in the morning and another in the afternoon, the evening being devoted to the reception tendered at the Academy of Fine Arts.

Thursday there will be an excursion on special train to Bethlehem, Pa., to view the new plant of the Bethlehem Iron Works

also to visit the Lehigh University and the Lehigh Zinc Works. In the evening a complimentary dinner will be given to the members by the citizens of Philadelphia.

The following papers will be presented and discussed:

Lewis F. Lyne: "The Use of Kerosene Oil in Steam Boilers."

Henry I. Snell: "Method of Ventilating and Heating Office and Warehouse."

John E. Sweet: "A New Principle in Piston Packing."

R. H. Thurston: "Internal Friction of Non-Condensing Engines."

John J. Grant: "The Milling Machine as a Substitute for the Planer."

Henry I. Snell: "Centrifugal Fan Blowers and the Power to Drive Them."

John Coffin: "Steel Car Axles."

Oberlin Smith: "Power Press Problems."

Frank Van Vleck: "Standard Section Lining."

Percy A. Sanguinetti: "Divergencies in Flange Diameters in Pumps, etc."

Wm. O. Webber: "Centrifugal Pump Efficiencies."

Gaetano Lanza: "Friction of Toothed Gearing."

Jerome Sondericker: "How to Test Strength of Cements."

H. de B. Parsons: "Influence of Sugar upon Cements."

James M. Dodge: "New Method of Stocking and Reloading Coal."

E. C. Felton: "Results Obtained from Steel Tested Shortly after Rolling."

O. C. Woolson: "Roadbed for Railroad Bridge Structures."

Practical Drawing.

BY J. G. A. MEYER.

THIRTY-EIGHTH PAPER.

Proposition 48 *A*.

369. IF A GIVEN LINE BE PERPENDICULAR TO ANY GIVEN OBLIQUE PLANE, THE VERTICAL PROJECTION OF THIS LINE WILL BE PERPENDICULAR TO THE VERTICAL TRACE OF THE GIVEN PLANE; AND THE HORIZONTAL PROJECTION OF THE SAME LINE WILL BE PERPENDICULAR TO THE HORIZONTAL TRACE OF THE GIVEN PLANE.

In order to make this proposition as plain as possible we will not indicate the given plane simply by its traces and a ground line, as is always done in descriptive geometry, but we will give two separate views of the given oblique plane and line, with the planes of projections represented as standing perpendicular to each other.

In Fig. 260 the rectangle *A B C D* represents the vertical plane of projection, and *A B r s* the edge of the horizontal plane of projection which forms a right angle with the former. The line *g h* is the vertical trace of the given oblique plane *g h i;* that is to say, the line *g h* is the line in which the oblique plane *g h i* will intersect the vertical plane of projection (see Art. 232, and Fig. 170). The line *o p* is the projection of the given line which stands perpendicular to the plane *g h i*.

In fact, assume that Fig. 260 represents the elevation of two drawing boards standing perpendicular to each other. *A B C D* is the face of the drawing board which stands in a vertical position, this face representing the vertical plane of projection; and *A B r s* is the edge of the other drawing board, which lies in a horizontal position, this face *A B* representing the horizontal plane of projection; in this case, the line *A B* also represents the ground line, that is, *A B* is the line in which the faces of the two drawing boards meet each other.

Now, assume that a piece of tin or thin sheet iron *g h i* perfectly straight is cut so that it will touch the face of the vertical board in the line *g h*, and the face of the horizontal board in the line (*g i*, $g_2\ i_2$). The piece of tin will represent the given oblique plane, and the line *g h* will be what is called in descriptive geometry the vertical trace of this plane (see Arts. 229, 230, 231 and 232). Let *o p* represent the projection of a thin piece of wire perfectly straight and standing perpendicular to the given oblique plane; this wire will represent the given line.

Fig. 261 represents a plan of these drawing boards, tin and wire. In this view we see the face *A B E F* of the horizontal board, and the edge *A B* $r_2\ s_2$ of the vertical board; $g_2\ h_2\ i_2$ represents the given oblique plane, and the line $g_2\ i_2$ its horizontal trace. The line $o_2\ p_2$ is the horizontal projection of the wire or the given line (*o p*, $o_2\ p_2$).

We would here call the attention of the student to Article 332, in which the manner of designating lines and points is explained.

It is now to be shown that the projection of the wire, that is, the given line (*o p*, $o_2\ p_2$) on the vertical plane of projection will be perpendicular to the vertical trace *g h* of the oblique plane *g h i;* and the horizontal projection $o_2\ p_2$ of the same given line (*o p*, $o_2\ p_2$) will be perpendicular to the horizontal trace $g_2\ i_2$ of the oblique plane.

The plane which projects the given line (*o p*, $o_2\ p_2$) on the vertical plane *A B C D* must be perpendicular to the oblique plane (*g h i*, $g_2\ h_2\ i_2$), because the projecting plane contains a line, that is, the given line, which is perpendicular to the oblique plane; but this projecting plane is also perpendicular to the vertical plane of projection *A B C D* (Art. 236), and therefore must be perpendicular to the line in which the vertical plane of projection and the oblique plane intersect each other, that is, to the vertical trace *g h*.

To prove this in another way, we can apply the principle given in Proposition 48: Let the point *p*, Fig. 260, be the point in which the line *o p* pierces the plane *g h i*. Assume that through the point *p* a line *k l* is drawn on the oblique plane parallel to the trace *g h*. In this manner we obtain two lines, namely, (*o p*, $o\ p_2$) and *k l*. These two lines in space are perpendicular to each other, and since *k l* is parallel to the vertical plane of projection (because it is parallel to the trace *g h*), it follows, according to Proposition 48, that the projections of the lines *k l* and (*o p*, $o_2\ p_2$) will be perpendicular to each other; and since *k l* is parallel to the trace *g h*, it follows that the projection *o p* must also be parallel to the trace *g h*. In a similar manner it can be shown that the horizontal projection $o_2\ p_2$ will be perpendicular to the horizontal trace $g_2\ i_2$.

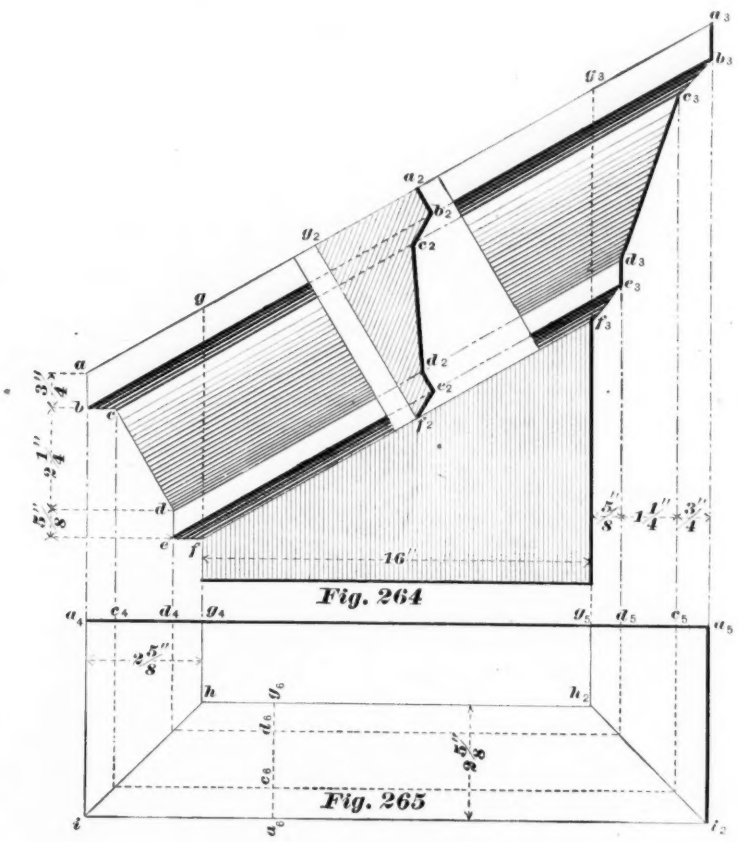


Fig. 264

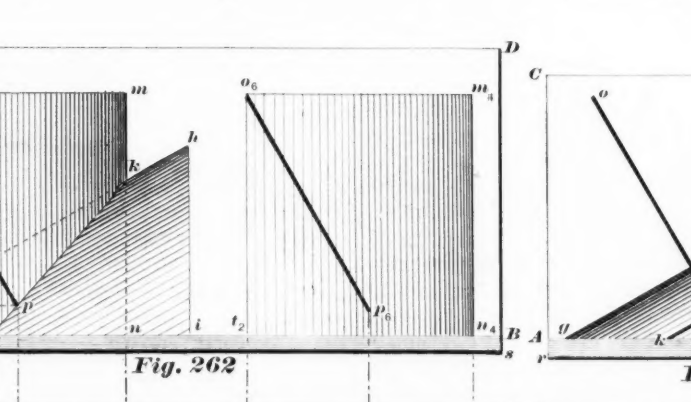


Fig. 265

Fig. 262

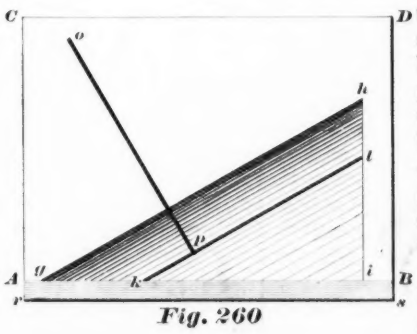


Fig. 260

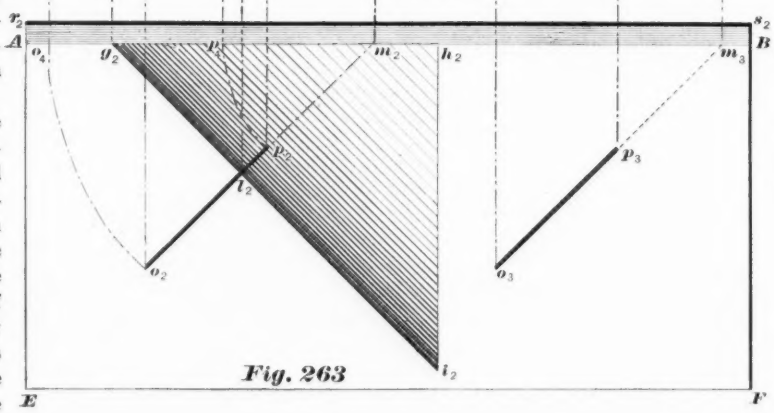


Fig. 263

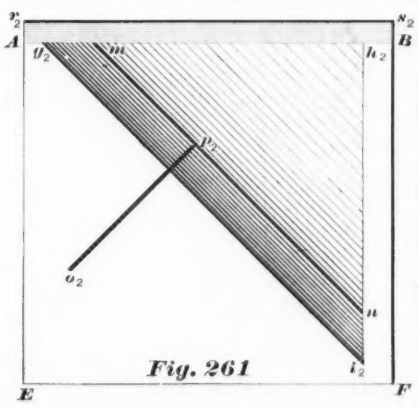


Fig. 261

370. The converse of this proposition is also true. For instance, if the projections of a given line are perpendicular to the traces of a given plane, the given line in space is perpendicular to the given plane. This may be proved in the following manner: We have seen that the projecting planes will be perpendicular to the traces of the given plane, and therefore the projecting planes are perpendicular to the oblique plane. But the projecting planes will intersect each other in the given line in space (Art. 236, and Figs. 171, 173, 179), and therefore when the projections of a line are perpendicular to the traces of a given plane, the line in space is perpendicular to the given plane.

Problem 49.

371. TO DRAW FROM A GIVEN POINT A STRAIGHT LINE WHICH SHALL BE PERPENDICULAR TO A GIVEN PLANE; ALSO TO FIND THE POINT IN WHICH THE PERPENDICULAR LINE PIERCES THE PLANE, AND THE LENGTH OF THE LINE FROM THE GIVEN POINT TO THE POINT IN WHICH THE PLANE IS PIERCED.

Figs. 262, 263. Let *o* be the vertical, and o_2 the horizontal projection of a given point in space. Also let *g h* be the vertical trace, and $g_2\ i_2$ the horizontal trace of a given oblique plane (*g h i*, $g_2\ h_2\ i_2$). Through the point *o* draw a line *o p* perpendicular to the vertical trace *g h;* and through o_2 draw a line $o_2\ p_2$ perpendicular to the horizontal trare $g_2\ i_2$. According to Proposition 48*A*, the lines *o p* and $o_2\ p_2$ will be the projections of a line in space which is perpendicular to the given oblique plane represented by the traces *g h* and $g_2\ i_2$.

Our next step will be to find the point in which the line (*o p*, $o_2\ p_2$) pierces the oblique plane. Prolong the line $o_2\ p_2$ (Fig. 263) to cut the line *A B* in the point m_2. Through the point m_2 draw a line $m_2\ m$ perpendicular to the line *A B*, cutting the vertical trace *g h* in the point *k;* also through the point l_2, in which the line $o_2\ m_2$ cuts the horizontal trace $g_2\ i_2$, draw a line perpendicular to *A B*, cutting *A B* (Fig 262) in the point *l*. Join the points *k* and *l* by a straight line and cutting the line *o p* in the point *p;* this point *p* is the vertical projection of the point in which the line (*o p*, $o_2\ p_2$) pierces the oblique plane. Through the point *p* draw a line perpendicular to the line *A B*, cutting the line $o_2\ m_2$ in the point p_2; this point p_2 is the horizontal projection of the point in which the line (*o p*, $o_2\ p_2$) will pierce the oblique plane.

It now remains to find the true length of the line which is represented by the projections *o p* and $o_2\ p_2$; or in other words, to find the shortest distance between the given point (*o*, o_2) and the oblique plane.

Through the point *o* (Fig. 262) draw a line $o_5\ m$ parallel to *A B;* also through the point *p* draw a line *p* p_5 parallel to *A B*. From the point m_2 (Fig. 263) as a center, and with a radius equal to $m_2\ o_2$ describe an arc, cutting *A B* in the point O_4; again from the point m_2 as a center, and with a radius equal to $m_2\ p_2$ describe an arc, cutting the line *A B* in the point p_4. Through the point o_4 draw a line perpendicular to *A B* and cutting the line *m* o_5 in the point o_5; also through the point p_4 draw a line perpendicular to *A B* and cutting the line *p* p_5 in point p_5. Join the points o_5 and p_5 by a straight line, then will the line $o_5\ p_5$ represent the true length of the line (*o p*, $o_2\ p_2$), or we may say, the length of the line $o_5\ p_5$ represents the shortest distance between the given point (*o*, o_2) and the given oblique plane.

The following remarks will explain the construction; and in order to make the explanation as comprehensive as possible we will show separately the projections $o\ p$ and $o_2\ p_2$ of the given line in space.

Let $o_6\ p_6$ and $o_3\ p_3$ represent separately the projections of the given line in space, and assume a plane perpendicular to the horizontal plane of projection to have been passed through the given line, then this plane will be represented in Fig. 263 by the straight line $o_3\ m_3$, and in Fig. 262 the same plane will be represented by the rectangle $m_4\ n_4\ o_6\ t_2$. The line $m_4\ n_4$ is the vertical trace of this plane, and is found by drawing through the point m_3 (in which the line $o_3\ m_3$ cuts the line $A\ B$) a line $m_3\ m_4$ perpendicular to $A\ B$, and that portion $m_4\ n_4$ of this line above the ground line $A\ B$ is the vertical trace. This plane contains the given line in space, and is in fact its projecting plane.

The same plane is represented by the rectangle $m\ n\ o\ t$, obtained in a similar manner as the former; the line $m\ n$ is its vertical trace, part of which $(k\ n)$ is hidden by the oblique plane, and therefore the part $k\ n$ is represented by a dotted line. The plane $m\ n\ o\ t$ is perpendicular to the oblique plane, because it contains a line $(o\ p,\ o_2\ p_2)$ which is perpendicular to the oblique plane. The plane $m\ n\ o\ t$ and the oblique plane intersect each other in the line $k\ l$, and this line is obtained by finding two of its points, thus: In Fig. 262 it is seen that vertical trace $g\ h$ of the oblique plane, and the vertical trace $m\ n$ of the projecting plane, intersect each other in the point k, and this point k is one of the points sought. In Fig. 263 it is seen that the line $o_2\ m_2$, which represents the horizontal trace of the projecting plane, cuts the horizontal trace $g_2\ i_2$ of the oblique plane in the point l_2. Through this point l_2 a line perpendicular to $A\ B$ is drawn, cutting $A\ B$, in Fig. 262, in the point l; this point l is the vertical projection of the point represented in the horizontal projection by l_2, and is the other point sought. Joining the points l and k, we obtain the vertical projection of a line in which the projecting plane and oblique plane intersect each other; the line $l_2\ m_2$ is the horizontal projection of the same line. The projecting plane contains the given line $(o\ p,\ o_2\ p_2)$ and also the line of intersection $(l\ k,\ l_2\ m_2)$, and therefore the point $(p,\ p_2)$ in which these lines cut each other must be the point in which the given line pierces the oblique plane.

To find the correct length of the given line $(o\ p,\ o_2\ p_2)$ or, in other words, the shortest distance between the given point $(o,\ o_2)$ and the oblique plane, we have only to revolve the plane of projection $m\ n\ o\ t$ around its vertical trace $m\ n$ till it coincides with the vertical plane of projection. By so doing the path of the point $(o,\ o_2)$ will be represented by a straight line $o\ o_5$ in the vertical projection and by an arc $o_2\ o_4$ in the horizontal projection, and consequently the point o_5 in which the vertical $o_4\ o_5$, and the horizontal line $o\ o_5$ cut each other is the position of the extremity of the given line when the projecting plane coincides with the vertical plane of projection (Art. 325). In a similar manner the point p_5 is found, and the distance between the points o_5 and p_5 will be the shortest distance between the points $(o\ o_2)$ and $(p\ p_2)$, or the shortest distance between the given point $(o\ o_2)$ and the oblique plane.

Directions.—Fasten another sheet to the drawing board, draw the border lines, and space off as before; mark the spaces Prob. 49, Prob. 50, etc. In space marked Prob. 49 draw an elevation and plan of two drawing boards, as shown in Figs. 262 and 263, draw these as large as the space will permit. In the elevation draw a line $g\ h$ making any angle with the ground line $A\ C$, and in the plan draw a line $g_2\ i_2$ making any angle with the line $A\ C$, either greater or less than the angle in the elevation; and assume the lines $g\ h$ and $g_2\ i_2$ to be the vertical and horizontal trace of a given oblique plane. Be careful to have the point in which the trace $g\ h$ cuts the line $A\ B$ in the elevation, and the point in which the trace $g_2\ i_2$ cuts the line $A\ B$ in the plan, lie in a straight line perpendicular to $A\ B$. In the elevation mark off any point o, and in the plan a point o_2; assume these points to be the projections of a given point in space. In marking off the points o and o_2 the only precaution that need to be taken is to have these points lie in a straight line drawn perpendicular to $A\ B$. Through the points $o\ o_2$ draw the projections of a line which is perpendicular to the given oblique plane and find the projections p and p_2 of the point in which the line will pierce the oblique plane; also find the shortest distance between the points $(o\ o_2)$ and $(p\ p_2)$.

Problem 50.

PRACTICAL APPLICATION OF PROBLEMS 44 AND 45.

372. A LEVEL CROWN MOULDING BEING GIVEN, TO FIND THE FORM OF THE RAKING MOULDING AND ALSO THE FORM OF LEVEL RETURN MOULDING AT THE TOP.

Figs. 264, 265. Let $a\ b\ c\ d\ e\ f\ g$ be the form of the given crown moulding, and the line $a\ a_3$ the amount of inclination of the raking moulding; it is required to find the form or outline of section of the raking moulding, and also the form $a_3\ f_3\ g_3$ of the return moulding.

In Fig. 265 we see that the lines $h\ i$ and and $h_2\ i_2$ bisect the angles formed by the edges of the mouldings, and therefore the widths $a_4\ g_4$, $a_5\ g_5$ and $a_6\ g_6$ must be equal to each other; and for similar reasons the distances between other members of the moulding, such as $a_4\ c_4$, $a_5\ c_5$ and $a_6\ c_6$ will be equal to each other.

Through the points b, c, d, e, f, draw lines parallel to the line $a\ a_3$. To obtain the correct form of the raking moulding we must find the outline of a section obtained by cutting the moulding perpendicular to the line $a\ a_3$ or, in other words, a section obtained by cutting the raking moulding square across. Consequently, through any point, as g_2 in the line $a\ a_3$, draw a line $g_2\ f_2$ perpendicular to the line $a\ a_3$. The width $a_6\ g_6$ of the raking moulding is equal to the width $a_4\ g_4$ of the level crown moulding; therefore, from the point g_2 on the line $a\ a_3$ lay off a point a_2; the distance between the points g_2 and a_2 must be equal to that between the points a_6 and g_6, or that between the points a_4 and g_4, and not equal to the distance between the points a and g, because the latter does not represent the shortest distance, and consequently not the true width between the lines $a\ b$ and $g\ f$. Through the point a_2 draw a straight line $a_2\ b_2$, parallel to $g_2\ f_2$; the line $a_2\ b_2$ must be drawn parallel to $g_2\ f_2$, because $a\ b$ is parallel to $g\ f$. On the line $c\ c_3$ lay off from the line $g_2\ f_2$ a point c_2; the distance between the line $g_2\ f_2$ and the point c_2 must be equal to the distance between the points g_6 and c_6; join the points b_2 and c_2 by a straight line. On the line $d\ d_3$ lay off from the line $g_2\ f_2$ a point d_2; the distance between the line $g_2\ f_2$ and the point d_2 must be equal to that between the points g_6 and d_6. Through the point d_2 draw a line $d_2\ e_2$ parallel to the line $g_2\ f_2$, cutting the line $e\ e_3$ in the point e_2. Join the points e_2 and f_2 by a straight line; also join the points c_2 and d_2 by a straight line, which will complete the section of the raking moulding and show its true outline or form.

To find the form of the return level moulding we have only to draw the vertical lines through the points d_5, c_5 and a_5, cutting the raking lines in the points d_3, c_3, b_3 and a_3, as shown, and then join the proper points by straight, as indicated. Or, if plan has not been made of these mouldings, then the distance between the lines $g_3\ f_3$ and $a_3\ b_3$ must be equal to that between the lines $g\ f$ and $a\ b$; the distance between the lines $g_3\ f_3$ and $d_3\ e_3$ equal to that between the lines $g\ f$ and $d\ e$; and the distance between the point c_3 and the line $g_3\ f_3$ equal to that between the point c and $g\ f$. Join the points c_3 and d_3 by a straight line, and also join e_3 and f_3 by a straight line. The outline $a_3\ b_3\ c_3\ d_3\ e_3\ f_3\ g_3$ will be the form of the level return moulding.

Directions.—In the space marked Prob. 50, draw a level crown moulding according to the dimensions given in the illustrations, and let the inclination of the raking moulding form an angle of 36 degrees with a horizontal line. Find the form of the raking moulding and also that of the return moulding.

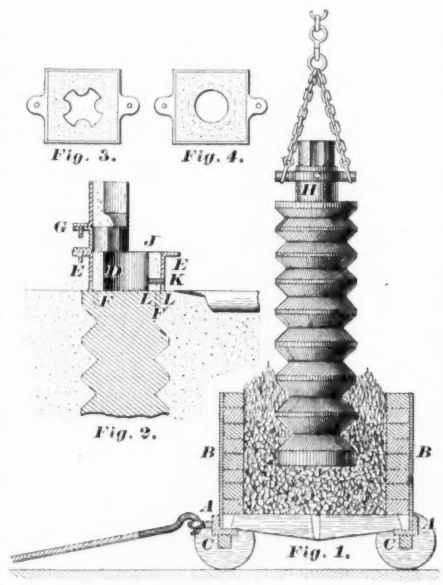
A former victim writes us: "Fink is again around with his compound, a prominent manufacturer in Newark, N. J., having just paid $150 for the valuable (?) receipt. Give him a little more publicity."

Mending Broken Castings.

BY ROBERT E. MASTERS.

In foundries where there is much of this work to be done, the carriage, Fig. 1, is a very handy device. The angle frame $A\ A$ is of cast-iron; the shell B for the furnace can be made of old pieces of boiler-iron riveted together; the grate bars rest on the frame inside of this. There is nothing important about bricking up. We have frequently laid pieces of broken fire brick in loose, without any mortar, or, where the joints between the brick are very bad, used common wet moulding sand to fill up.

If the shell of this furnace is hollowed out in a half circle at the top on opposite sides, it can be used for the class of work illustrated in the last article on this subject. The wrought-iron axles $C\ C$ are riveted on a cast frame. Plain wheels, either spoke or web, 3″ or 4″ tread, are used, so it can be run out of the way when not in use. If there



MENDING BROKEN CASTINGS.

is space to spare in reach of the crane, this rig can be made with plain round legs, cast on to support it, and trunnions on the side of the frame to handle it. This would dispense with wheels and axles.

Often the bearing or "wobbler" will wear out on both ends of a roll, while the body and grooves are as good as new; but more frequently it is the neck on the end of the roll where the most strain is, the other end of the roll wearing very little. I have known one roll to wear out three bearings, each of them giving good service, before the roll itself was condemned as being worn out. To burn a new bearing on, the old one must first be cut off in a lathe, level with the bottom of the roll.

The left-hand side of Fig. 2 will show moulding the new neck. The roll is rammed up in the floor; it is not particular whether the top of the roll is level with the floor or extends above it. Center the bearing D, and put on the flask E, usually an iron one, and small enough to rest on top of the roll. Pieces of rod or large nails can be rammed up in each corner next to the roll, to serve as a guide, as seen at the dotted lines $F\ F$, allowing a little play for the expansion of the roll when heating it. If a three-parted flask cannot be found to suit, it is not really necessary to have a parting at G. Figs. 3 and 4 are plan views of the "wobbler" and "sink head." The lower piece that forms the bearing is blackwashed and skin dried; the others are of green sand. The roll is lifted out; a collar, with trunnions fastened on the other neck with set screws, is hung with the chains and swung in the furnace, as at H, Fig. 1. If both ends are off, a collar is fastened around the body of it.

The end of the roll is heated red hot with a charcoal fire; after the first fire burns down enough, coal can be added to keep the roll hot until the iron is ready. If there is danger of melting the end of the roll, it can be hoisted up a little above the fire. Experience will teach about the time to start the fire in the furnace so the roll will be ready for the iron without the waste of much charcoal.

With small rolls, when ready for the iron, the roll is lifted out of the furnace and set on the floor red hot end down, about the right distance from the hole, and the chain is taken off; the roll is then pushed over so it will drop in the hole, red end up; it is straightened up by pulling on it with a couple of hooks, and the hole filled up and tramped off around the top, the end of the roll brushed off, and the flask E that forms the bearing, set on and tucked around the edge. The right hand side of Fig. 2 at J, shows the work at this stage. The flow off K is as near the bottom of the flask as convenient, leaving only enough sand between the bottom of the run-off and top of the roll to keep the iron from cutting into the roll at L. After the iron has cut into the roll enough to unite as described in previous articles, stop up the flow-off, skim off the iron, brush off the top of the flask at J, put on Figs. 3 and 4, lay on a weight and fill them up.

Large rolls are swung from the center, so that when they are lifted out of the furnace they can be revolved and lowered into the hole without any time being lost.

The amount of iron it takes to burn on a bearing is very indefinite; it is owing a great deal to how hot the roll is made, and how hot the fluid iron is, and to the manner in which it is handled. Rolls that weigh from 500 to 1,000 pounds, and have necks from 4″ to 5″ diameter, we usually burn on good and strong with from 300 to 600 pounds of iron, and use from 1,800 to 2,400 pounds to burn on necks from 10″ to 14″ diameter, on rolls running as high as 14,000 pounds. These figures include the iron to make the neck and what has flowed through.

LETTERS FROM PRACTICAL MEN.

Solution for Blacking Zinc.

Editor American Machinist:

In your columns of questions and answers for November 19, H. A. L., Philadelphia, asks for a simple receipt for blackening sheet zinc, so that it will not easily rub off for the purpose of drawing lines. I have used a solution for years past which answers for cast-iron, wrought-iron, steel and zinc. It is as follows: To 4 ounces of clear water add 1 ounce of powdered sulphate of copper (blue stone), then one-half teaspoonful of nitric acid. Before applying this solution be sure and brighten the surface which is to be coated. When using, dampen a clean piece of waste, passing it over the work. When the surface is large, use different parts of the dampened waste, so that the surface will have the same color. Generally the waste turns black after being drawn across the work, and also produces black streaks on the surface coated; this applies only to cast-iron, wrought-iron and steel. These metals when coated have the appearance of copper, but with zinc the surface is black. Rub the surface dry, after applying, with clean waste.

C. E. SIMONDS.

Jamaica Plain, Mass.

The Creep of Belts.

Editor American Machinist:

In the last issue of the AMERICAN MACHINIST, W. M. F., Toronto, writes to inquire what to do to prevent his belt from creeping, as he wishes it to produce a positive motion. We were in the same fix awhile ago, and got over it very easily by setting turned plugs in our pulleys and letting them project out like the teeth in a wheel, and cutting holes in our belt to match them. We use extra heavy rawhide, and stretch it

well before using. The plugs, or teeth rather, need not project over $\frac{1}{4}$ or $\frac{3}{8}$ of an inch, and can be set quite a distance apart. The projecting ends are turned off so that they will engage in and leave the belt without any trouble, and it works very nicely.

C. R. CARLEY.

[While, as our correspondent says, his arrangement, no doubt, works well for his purpose, we hardly think it would prove a practical expedient for general use, and do not think it would entirely do away with creeping.]

Eccentric Out of Line.

Editor American Machinist:

I once had the same trouble with an engine as that given in question No. 470 My engine was a small one of 40 horse-power, doing at times only about 15 horse-power work; so you see I had an easy chance to see how the noise would vary. I tried almost everything to stop it, but could not make a permanent cure. I noticed when I would inject my cylinder oil it would cease for a while, but that was all. So I determined to see if my engine was in line all over. I lined it myself when I started it, but was not an experienced hand at that time. I took my book and went through the lining rules given there as best I could. When I came to line my engine again I found my eccentric and rod $\frac{9}{16}''$ out of line with the valve seat; of course with that there was a cramp all round if the jaw nuts were properly adjusted.

Now possibly the new steel seat may produce the same result in the case of your correspondent, having been overlooked by some means or other. I think I made my trouble myself when I reversed the engine, as the eccentric was set on the wrong quarter for our work. C. L. C.

Brock's Quadruple-Expansion Marine Engines.

Mr. Waller Brock, of Messrs. Denny & Co., Dumbarton, seems to have made a decided step in advance in the way of adapting the marine engine to the use of still higher steam pressures than those which have yet been employed in triple-expansion engines. His system has been applied by Messrs. Denny & Co. to the machinery of six new steamers, with very marked success, and the firm have already in hand orders to adapt the system to no fewer than six existing steamers. One large steamer, the Tenasserim, belonging to the British and Burmese Steam Navigation Company, of Glasgow and London, has just undergone the process of conversion, and on Wednesday, Oct. 26, the engines of this vessel were subjected to trial in an experimental run which she made on the Firth of Clyde. As this is the first steamer whose machinery has been converted on Mr. Brock's plan, a very considerable amount of interest has been displayed in regard to it, both by marine engineers and by shipbuilders, more especially on the Clyde.

Mr. Brock's arrangement is one which enables the ordinary type of compound marine engine to be converted at very moderate cost, into the most efficient type of modern engine. In order to effect the conversion, there is required the removal of the old boilers and steam cylinders and the substitution for them of high pressure boilers and four new cylinders, the latter being so arranged as to occupy the place of the removed cylinders without any alterations being made in any of the existing valve or other gear. The new cylinders are arranged tandem fashion, No. 1 being set on the top of No. 2, and No. 3 on the top of No. 4. In this way Nos. 1 and 3 form the covers of Nos. 2 and 4, respectively, and there is no exposed stuffing-box between the top and bottom cylinders. The valves for all the cylinders are arranged in the casings of the lower cylinders so that there are no more stuffing-boxes and the like to attend to in the engines in their transformed state than was the case before the alteration was made; indeed, there are rather fewer things requiring attention, inasmuch as the piston-rods are not carried through the top cylinders. By Mr. Brock's arrangement the steam is allowed to expand through each of the four cylinders in succession, beginning at No. 1.

In the case of the Tenasserim four single-ended boilers, designed for a steam pressure of 60 lb. per square inch, were replaced by two double-ended boilers capable of providing steam of 180 lb. pressure. Then, again, the two steam cylinders that were removed had diameters of 47 in and 82 in. respectively, while the four cylinders that were substituted for them have diameters of $24\frac{1}{2}$ in., 37 in., 49 in., and 72 in. respectively—the length of piston stroke being 42 in. in both instances.

The trials that were made on the 26th ult. fully justified all the expectations formed of the converted engines by the persons interested. With the same engines, except for the substitution of new cylinders and new boilers as already noted, an increase of power to the amount of 40 per cent. was developed, with a corresponding increase in the speed of the vessel. The engines worked with perfect smoothness and regularity. The vessel was fully loaded for sea, and she maintained with ease a speed of $11\frac{3}{4}$ knots per hour, as ascertained by trials made on the measured mile at Skelmorlie, under the most unfavorable weather conditions, there being half a gale blowing at the time. When the vessel was tried at light draught the engines indicated 1,800 horse-power, with 68 revolutions per minute; and at deep draught on the day mentioned 1,700 horse-power was developed, with 60 revolutions per minute.

In their altered form the engines of the Tenasserim are fitted with Weir's pumps, feed-heater, and distiller. Owing to want of time it was not possible to carry out a trial to determine the consumption of coal, but arrangements have been made by the owners of the vessel with the captain such as will enable them to go into the question of speed and saving of coal at the end of the first outward voyage to Rangoon. As it is, however, careful and exhaustive practical trials have been made by Messrs. Denny & Co., who carried out the alterations in the Tenasserim, bearing on the relative efficiency of triple and quadruple machinery; and though such a question is doubtless open to considerable difference of opinion, owing to the difficulty of getting actual comparisons, yet they are satisfied that the latter shows an advantage of from six to eight per cent. over the former.—*Engineering.*

At the time of the death of Herr Krupp, he had had in hand for some time a gun for the Italian Government which has just been finished. The gun, which weighs 118 tons, is 45 feet long, and its caliber nearly 16 inches. It is rifled, and throws a steel projectile weighing nearly a ton, with a charge of 6 cwt. of powder. The shot can pentrate a steel armor plate 36 inches thick at the mouth of the gun, or 29 inches at a distance of a mile. It is not believed that any armored ship in the world can endure the fire from such a gun.

Vertical Drills—Their Construction and Uses.

By JOHN J. GRANT.

Vertical drills are made in a great variety of forms and sizes, often designed especially for one particular job.

The standard drills manufactured for the market may be enumerated as follows: The suspension drill, in which the entire machine is hung from the ceiling or roof, leaving a clear space on the floor for the work.

The column drill, having a column fastened to a base-plate, terminating in a "goose neck" that holds the top end of the drill spindle and a table or platen hung in an arm that is generally made to revolve around the lower part of the column, besides revolving in its own bearing and adjustable vertically.

The "gang" or multiple spindle drill, generally made for light drilling, and in which the drill spindles are usually made without vertical adjustment, the drill table being raised and lowered by means of a lever and foot-treadle.

The radial drill, having a column with an arm for the drill-head adjustable vertically, and the drill-head sliding horizontally on it, the arm and drill-head made to swing around the column, and in the universal radial drill an adjustable head to drill at any angle.

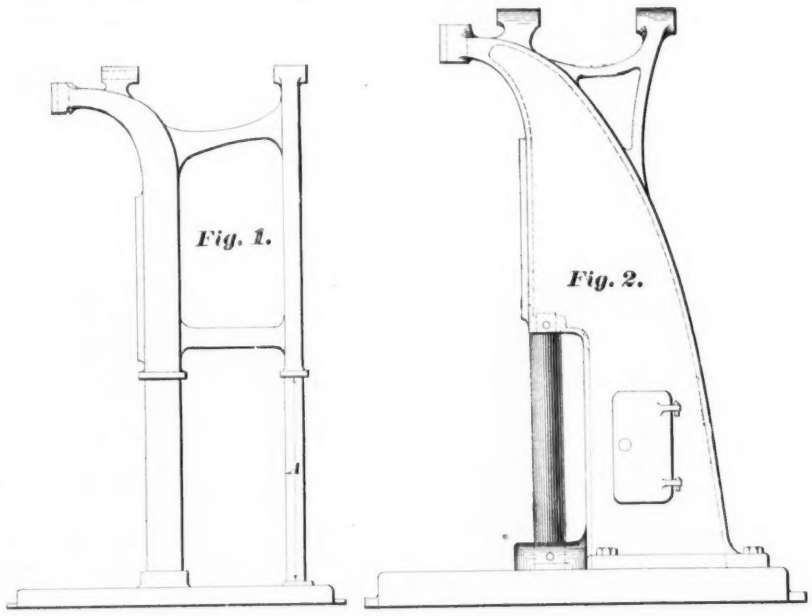
The beam or rail drill, having two uprights or columns placed any distance apart, having a beam or rail fitted in the same manner as the cross beam on the planer, made to raise or lower by two vertical screws geared together by a shaft across the top, with one or more drill-heads fitted to the beam and made to traverse horizontally, the drill spindles worked either by hand or power.

The above list comprises about all the kinds of vertical drills designated as standard tools, or what can be had ready made. In the articles to follow, I shall endeavor to point out the good qualities of the above tools, as well as their defects.

The first to receive a "drubbing" will be the universally used common upright drill made in some form or other by nearly every maker of machine tools in the country, as well as by many others who put on the market an illy-made apology for a drill, constructed on neither scientific nor common sense principles.

The purchaser, too, is mostly to blame for the motley crew of this class of tools, as he is generally on the hunt for something cheap, and, as long as there is a demand for rubbish, there will always be a full supply.

The requisites for a good upright drill are as follows: First and foremost is accuracy, or perfect alignment of all the various parts; next, rigidity; as without this, accuracy is of no account; last, power that is sufficient to do any work that is required of it.



VERTICAL DRILLS.

Right here, let me ask: How many upright drills are there made embodying all of the above points?

Everybody admits that the "Yankee" made upright drill is the handiest tool of its kind in use, while its defects are many. The column, as a general thing, is too light, so that it springs backward when doing a heavy job.

Some makers use a double column, as shown in Fig. 1. This is a valuable addition, as can be easily proved by any one having a drill of this kind, in the following manner: Run the drill table down to its lowest point, and, if the drill head is adjustable on the column, raise to its highest point; put a piece of iron between the end of the drill spindle and the table, turn the hand feed wheel, and note the amount of spring in the column. Now take out the piece marked A, Fig. 1, between the base and lower shaft bracket, and notice the vast difference.

I would suggest that all upright drill columns be made as in Fig. 2, as this is the strongest possible form that can well be used for that purpose.

The next fault lies in the drill table and its arm or support. This is never made stiff enough. The arm where it clasps the column should be about double the length it is generally made, and should also be made very strong to stand the torsional strain, as more than half the work done on the upright drill is outside, or away from the center of the table. The table itself should have a much larger shank, and a bearing farther away from the center; also made deeper and ribbed to prevent springing. Even when made as strong as possible there will be considerable spring while doing heavy work, and a light screw-jack, with a quick adjustment, is a very handy thing to have to put directly under the drill spindle. Next comes the driving power, which, in my opinion, should not be made as it usually is, but should be more direct, or nearer the drill end of the spindle, as the torsion on a long spindle driven from one end and the work being done at the other is considerable, especially in boring or facing off with a large tool. Should the spindle be made heavy enough to stand such work, it would be at the expense of light running and easy manipulating. The better way is to get the driving power nearer the work. There should be on every drill a depth gauge, and also an automatic stop motion for drilling to positive depths, and insuring a piece of work from being drilled through. Every upright drill spindle should be fitted for some one of the standard tapers of Morse twist drills, according to the size, as this is now recognized as the standard taper for drills.

The spindle should have, in every case, a quick return. There is as much sense in running the carriage of an engine lathe back with a screw and crank as to raise a drill spindle ten to twenty inches in the same way.

Tools and fixtures, with suggestions as to the kind of work that can be done on an upright drill, and the best ways of doing it, will be the subject of another article.

A novel and ingenious application of electricity, permitting the services of waiters to be dispensed with, has lately been introduced into some of the Paris dining rooms. The new waiter consists of a small electric tram-car running on rails fitted to the dining-room table and leading into the kitchen. The current is supplied from accumulators, and by means of a switch located near each guest, the car is under complete control, and plates, dishes, etc., are brought and removed with silence and rapidity.

A meeting of railroad men was held recently in New York to consider the subject of steam heating. There seemed to be a general agreement that all the roads should adopt a uniform system so that cars changed from one road to the other, could be heated without trouble.

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The Commercial Value of Patents.

When a man has succeeded in inventing and patenting almost anything, he is likely to think well of his creation; he ought to do so. If he cannot see merit in it, it is not likely that others can, and it is in strict accordance with human nature that it should appear of more value to him than to another, even if each sees it with equal clearness. This they very seldom do, because the inventor has quite likely spent much time in considering its good qualities, and, unfortunately, in discounting those features that tell against it, while the reverse of this is likely to be true of the disinterested observer. In point of actual merit, then, it may be expected that the inventor will see his invention through eyes that are not entirely unprejudiced, and it is probably just as well that he does see it so. Seeing it so may help out his stock of perseverance, which is quite likely to be heavily taxed and overstrained. Under all ordinary circumstances, if he has invented something really good, an extra stock of appreciativeness will be needed before he is through with it.

But leaving aside, for the present, the question of real merit, or assuming that the inventor does not, even to himself, overestimate it, the question of the commercial value of his patent is very likely to puzzle him. Unless we are willing to admit that no invention is of consequence, except in so far as it will yield returns in money to the inventor or the possessor of the rights secured by patent—which is something the majority of people would not be willing to do—we have to consider not only the utility in a general sense of an invention, but what it is worth commercially as well. And when the inventor proposes to dispose of his right in an invention, this last consideration must take the place of all others. This may seem sordid, and all that, but it is business. It is anything but satisfactory to the inventor who really believes that he has devised something by which the whole world will be materially benefited—with perhaps a good deal of ground for his belief—to find that he cannot sell his right in it for fifty dollars; yet in a commercial sense that sum may be greater than its value as a means of making money, which is all there is about it that he can sell.

An inventor applies to a manufacturer to make an outright purchase of his invention. The manufacturer understands that before the new device can be manufactured so as to pay, it must be introduced, and this may be a tediously long and a costly operation. The cost of introducing may do away with all the profits for years, while there is always the possibility of ultimate failure. The inventor may thoroughly understand the merits of what he has invented, and has perhaps made an unprejudiced comparison between that and what the manufacturer builds in the same line. The price asked may appear very moderate, and from the inventor's standpoint it is easy enough to show that the profits will soon pay it. But the manufacturer knows he has a paying trade in what he already makes, and to take up the new device will prejudice that trade. If he pays what to him seems a large price he will do it with the idea of supplanting his present practice. To him the new plan is by no means sure to succeed; he has seen too many similar failures to be credulous. It looks too much like a game of chance, in which failure is the loss of something valuable to him. The commercial value of the patent to him would be very small, even though it looked promising. What he could really afford to pay for it would be what it seemed worth risking in cautiously and slowly working the device into use, in such a way as, in case of failure, to do little or no damage to his present business. This price would look absurdly small to the inventor, and it would be small, yet it is the commercial value of the patent. In a transaction of this kind the inventor looks at the profit of success only; the manufacturer looks more to the loss of failure, particularly in the prejudice to business already established.

Patents, improving good devices already in use, are seldom of much commercial value, except the change is radical. If patented by the manufacturer, they may, in connection with his business, become valuable, but even then their value is generally much overestimated. Those who watch the growth of a business connected in some way with a patent, are apt to give the latter credit for it all, when, in truth, the part it has played in the general success has been trifling.

The above is particularly true in reference to steam engine manufacture. An inventor, for example, goes to manufacturing on the basis of some patent of his own. He has peculiar interest in the invention because it is his, puts a good deal of energy into it, humors the weak points, improves them, and by virtue of skill and ability in general construction makes a success of steam engine building, sometimes in spite of the patent that is supposed to be the basis of his success. If the patent, upon which his success is popularly supposed to rest, had belonged to another, probably he could not afford to have taken it as a gift. In the present state of the art, the commercial value of patents on steam engines—that is, the price the builder could afford to pay—is nominally nothing, unless the skill of the inventor goes along with the patent to work out the general success of the machine. And the same is true of many other things that may, of themselves, possess considerable merit.

The Western and Southern land booms, taken in connection with the efforts to secure manufacture, seem to present anomalous conditions, at variance one with the other. The first aim in many of these localities appears to be to boom the land, and the second to secure manufacture as a help to the first. But manufacturers require cheap land, so, to secure them, land for their use is donated, while a fictitious value is placed on the rest. Now it looks as if, in the end, this fictitious value would operate directly against manufacture. Workmen have, many of them, an ambition to own their own homes. High land value is directly against this. If they do not own their homes they must pay rent, and this is increased by exorbitant prices for land. Workmen will stay where they can get the best wages, with the lowest cost of living, other things being equal, and this will tell against the manufacturers in the future if these fictitious values are maintained.

Perhaps the most satisfactory view to take of this matter is that the land boom part of these enterprises is reasonably certain to collapse, bringing things down to a normal condition, but even then, along with many others, manufacturers are likely to suffer. The enterprise in securing manufacture in the localities referred to is commendable, but the same cannot be said of the attempt to create wealth by forcing the price of land far above where there is any possibility of holding it. The reaction is likely to be disastrous.

It is beyond question that, taken as a whole, profit-sharing in industrial establishments in this country has not proved a success. There is evidently a difference in opinion as to what is really meant by profit-sharing; a need of better understanding between employers and employes. But the fact that in some instances it has worked successfully, gives at least room for hope that it may yet be better comprehended, and then made to work more satisfactorily. The manufacturer does not understand profit-sharing to be a lessening of his profits, and the workman does not understand that it shall lessen his wages. It must then mean greater production on the part of workmen, more care and thrift in matters pertaining to their work, with part of the extra profits resulting therefrom as remuneration. If this was better understood in the beginning, the plan of profit-sharing would either not be entered upon, or, if agreed to, it would more likely be a success.

Elsewhere we publish a brief synopsis of the programme of the Mechanical Engineers' meeting at Philadelphia. The list of papers as given foreshadows something excellent in this direction. Their titles indicate that they will be of a very practical character, and the names of the authors insure that the subjects will be well handled. There are many manufacturing establishments in Philadelphia that it is a treat to visit, and the excursion to Bethlehem, in view of the interest centering in the production of heavy steel in this country, will be unusually interesting. Everyone will appreciate the courtesy of a visit to the Academy of Fine Arts, and the dinner by the citizens is sure to be most enjoyable. There is every evidence that the Philadelphia meeting will be one of the most important and pleasant ever held; we hope and believe the attendance will be the largest yet.

It is pleasant, in these times, to hear of occurrences that show the better side of human nature, and demonstrate that men are a good deal inclined to treat others about as they are treated by them. The particular occurrence referred to is that of a railway company in England which met with serious reverses of a temporary character. Then the employes unanimously agreed to invite the company to accept their services gratis for several days, to help them out of their financial difficulties. The offer was not accepted, the stockholders coming to the relief, but it was fully appreciated, we may be sure. The reason for this act of consideration and loyalty on the part of the workmen, was the simple one that they had always been well treated by the company.

With the telegraph business of the country in the hands of a single company; with the prospect of the price of coal oil being doubled, and with the certainty that there is no limit to the price to which coal may go, the people of this country will be likely to frame a new definition for the word "monopoly." And in process of time they will call upon their legislators to frame laws that will at least moderate extortion. The goose that lays the golden egg is being strangled. The high prices of necessities will work hardship beyond calculation, but they will bring about the remedy correspondingly quicker.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(485) W. M. A., Bangor, Me., writes: 1. I have an engine pulley having a 4" bore which I wish to bush down to 3⅜" to fit an engine shaft. Will it be best to cut a key-way through the bushing and put in a key thick enough to engage the shaft and pulley or put one in for the bushing and one opposite for the shaft? *A.*—We should put in one key, cutting the bush away to make room for it, and making the key at least as wide as it is thick. 2. Will coal oil penetrate glass? *A.*—We think not.

(486) P. P., New Orleans, La., asks: Will you kindly inform me if a two-tube copper boiler 5¼" x 14", tubes 1 inch in diameter, is large enough to run an engine 2" x 2", the engine to make from 70 to 80 revolutions per minute? If not, please state the size required. *A.*—You do not state the steam pressure required. Assuming that the mean effective pressure in cylinder is 20 pounds per square inch, then your boiler is not large enough. You will need a boiler which has at least four square feet of heating surface, and 50 square inches for grate surface.

(487) R. J. J., Newark, N. J., writes: I wish to run a line of pipe through our shop for heating purposes, and want to get the right size. Some rooms are large and others small. Will you please give me a rule for finding the dimensions of main pipe and of those leading into the different rooms? *A.*—Positive rules for steam heating cannot be given. We would advise you to follow the

suggestions given in answer to question 279, and thus obtain the total number of square feet of heating surface required for your building. Having obtained the total number of square feet of heating surface, you must use your own judgment in determining the diameter of the main pipe.

(488) E. A. M., Beaver Dam, Wis., writes: I would be pleased to have you give me information relating to the following: What is the process for moulding rubber, to soften old rubber and remould it? Is it softened by steam under pressure, and is sulphur used? *A.*—See AMERICAN MACHINIST, answer to question 356, Sept. 3, 1887.

(489) J. A. M., Petrolia, Ont., writes 1. I want to chill the face of a casting which has small cavities ⅛ of an inch in diameter, ⅛ of an inch deep, and ⅛ of an inch apart, running diagonally across the face. Of what material shall I make the chill? And how thick shall the chill be made? *A.*—Make the chill of cast-iron about 4 inches thick. 2. Will the casting come out perfectly straight and true on the face, or would it require grinding? *A.*—That depends greatly upon your moulder. We believe that with care in moulding you should obtain a true face.

(490) A. W. P., Chicago, writes: 1. I would like to know how guns and rifles are bored. What are the tools used, and how are they made and operated? *A.*—To answer this question satisfactorily would require more space than can be given it in this column, but we think you will find the process and tools fully described in Appleton's Cyclopedia of Applied Mechanics. 2. How should half round bits be made? *A.*—You will find some information on this point in the AMERICAN MACHINIST, of Sept. 12, 1885. What you wish to know about calipers and their use can only be learned by observation and experience. It makes no difference whether one or both legs turn upon the rivet.

(491) F. R., New York, writes: I was under the impression that the thickness of boiler plate was limited by law to ⅝", but I can cite instances of boilers made of plates ⅞" or even 1¼" thick. Is there or was there ever any law on the subject? *A.*—There was never any law limiting the thickness of boiler sheets. It is not customary to make the furnace sheets, or those parts of a boiler with which fire comes in contact, more than ⅝" thick, but there is no law to prevent. In cases where there are inspection laws if fire sheets were made which were thought to be dangerously thick, the inspectors might refuse to pass the boilers. In some cases the thickness of the fire sheets of boilers under United States inspection is restricted even below ⅝".

(492) D., Portland, Ore.: I have a vertical engine 10" x 12" in a small boat; the engine makes about 160 revolutions, and it pounds on the lower center. I have tried giving more lead on the lower center, but that does not seem to do much good. I think there is trouble in the cushioning. I annex sketch of valve and seat. Can you tell what the trouble is? *A.*—You do not give the travel of valve, or say whether you have link motion, or constant travel. We do not, however, think the valve causes the pounding. Judging from the sketch, the exhaust is considerably choked, and there appears to be quite as much cushioning as you can well get from such a valve. The trouble is probably in the construction of the engine. Unless very carefully designed and well constructed such engines are almost certain to pound on the lower center.

(493) A. D., Eastport, Maine, asks: In determining the lead for an engine, theoretically, what conditions should be considered? Has the number of revolutions per minute the engine makes anything to do with it, or is it a question of piston speed? Which requires the most lead ordinarily, a screw or a beam engine? *A.*—We never knew anyone try to work out theoretically the proper amount of steam lead to give a valve. Engineers differ widely in this respect. Each one will give the valve such lead as in his opinion it works best with. With high piston speed, especially if the ports are rather small, or if they open slowly, it is generally customary to give more lead than when the reverse is true. Lead sometimes makes an engine run smoother; sometimes it runs smoother without lead. The indicator will show the effect of more or less lead, and should always be used for adjusting valves.

(494) A. R., Newark, N. J., writes: Would you kindly let me know the difference between the engine being left to stand on its center, and left to stand off the center? I have had a dispute with the night engineer; he says it does not matter whether it is off or on the center. I said it did. Therefore I call upon you to say which is right, so that I can prove to him that I am right, or quit running an engine if I am wrong. *A.*—If the engine has an unhooking gear it does not make any difference where the engine is stopped, so it is not on the dead center. If the engine has not an unhooking gear it is best to stop it directly after it has passed the dead center, so as to leave the greater part of the stroke through which the piston must travel in starting the engine, by which a sufficient momentum will be obtained to help the engine over the following dead center. If this answer should put you in the wrong, we see no cause for you to quit running the engine.

(495) E. M. L., Milwaukee, Wis., writes: 1. Please inform me in regard to the size of the ports of an engine whose cylinder is 4 inches in diameter and 6 inches stroke. The engine is to make 200 revolutions per minute, and to have 60 pounds pressure per square inch. The engine has four rock valves similar to a Corliss engine with drop cut off. Give also the bore of the valve seat, the length being 4 inches. *A.*—The area of each steam port should be ⅛ of a square inch, and the exhaust ports ⅛ of a square inch. Make the diameter of the valve as small as can be, done to open the steam port fully and have an opening sufficiently large for steam to enter the valve. 2. Can I obtain a quarter lead for valves without the use of two eccentrics? *A.*—You can obtain the lead you require with one eccentric by setting it correctly on the shaft. By quarter lead we suppose you mean one-quarter port opening at the beginning of the stroke. This seems to us to be an excessive lead. You should keep in mind that an increase of lead will result in a decrease of the distance through which the steam follows the piston.

(496) A. J. H., Denver, Col., asks: 1. What good or what harm does it do to use Babbitt metal in brasses, for instance locomotive rod brasses or stationary engine rod brasses? *A.*—The use of Babbitt metal in these brasses prevents them from heating; as the Babbitt metal is softer than the brass, it will hold the dust and prevent it from working all around the journal. We believe that all journals which are lubricated from the top should have Babbitt metal in the brass bearings. In locomotive driving boxes in which waste is used and the axle journal lubricated from below, the use of Babbitt metal will do more harm than good, because with Babbitt metal the axle will wear too rapidly and uneven. 2. Why will cold water find a leak in the boiler (when being tested) quicker than warm water? *A.*—Because when cold water is used the metal is not expanded as much as when the boiler is warm. In our opinion it is bad practice to use cold water for testing a boiler. 3. How should one proceed to get a position as engineer in the U. S. Revenue cutter service? What wages are paid? And how long will a man have to stay in the service? *A.*—To procure a position in the U. S. Revenue-cutter service, apply to the chief of the nearest navy yard; he will also inform you in regard to pay and the time required to serve.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Gear Wheels. See Adv., page 16.

Link-Belting.

Send for catalogue of Link-Belting.

Over 50,000,000 feet of Link Belt in use.

Link-Belt Machinery Co., Chicago and N. Y.

Shafting Straighteners. J. H. Wells, Tampa Fla.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Lamb Knitting Machine Co., Chicopee Falls, Mass.

Machine work and patternmaking. Anderson Machine Works, Peekskill, N. Y.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

For Electric Recording Steam Gauge, write Telemeter Co., 44 Barclay st., New York.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

For Catalogue of 2d hand lathes, planers, etc., write to John Steptoe & Co., Cincinnati, O.

For the best and cheapest four-horse engines, address Peter Walrath, Chittenango, N. Y.

R. Dudgeon, 24 Columbia st., New York. Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Solid Nickel-Seated "Pop" Safety Valves. Consolidated Safety Valve Co., 111 Liberty st., N. Y.

Queen lubricant for bolt and screw cutting, drilling, etc. Eureka Mfg. Co., foot E. 26th st., N. Y.

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Ice and Refrigerating Machines, 124 built, and all successful. David Boyle, 521 Monroe st., Chicago, Ill

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Drawing Materials, all kinds. Get catalogue. Mention this paper. G. S. Woolman, 116 Fulton st., N.Y.

Buy the Excel. Upright Drill; sizes, 20", 25", 28", 32", 36" swing. Currier & Snyder. Worcester, Mass.

The Improved Tabor Steam Engine Indicator, made and sold by The Ashcroft Mfg. Co., 111 Liberty st., N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

Inventors should write R. G. DuBois, Patent Attorney, 916 F street, Washington, D. C., for reliable information pertaining to patents.

Ten 16 in. Engine Lathes, ten 18 in. Eng. Lathes, ten 14 in. Eng. Lathes, ten 15 in. Engine Lathes. Nicholson & Waterman, Providence, R. I.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Nov. 5, p 15. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

The Brown & Sharpe Mfg. Co. have placed at No. 23 S. Canal st., Chicago, Ill., a sample line of milling machines and other machinery with S. A. Smith.

Machinists' supplies, brass goods, m'f'rs' supplies, polishing materials, all kinds wire, metals, etc.; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

W. H. Hoffman, consulting engineer, 94 Liberty st., N. Y. Mechanical engineering in all its branches; working drawings for the transmission of power by steam, water, air and electricity.

A. K. Mansfield & Co., mechanical engineers and experts in machinery patents; 18 years' experience, convincing references; practical working drawings; specimens, supervision. Room 256, 280 B'way, N. Y.

Hot Water Supply. A practical treatise on the fitting of hot-water apparatus for domestic and general purposes. By F. Dye. 82 pages, with 25 illustrations. 12mo., cloth, $1. Send for catalogue. E. & F. N. Spon, 35 Murray st., N. Y

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

Cost of Manufacture.—Every new subscriber to THE OFFICE (a practical 32-page monthly devoted to accounting, business management, and the art of advertising, published at $1 a year) is entitled to a copy of "Elements of Cost and Methods of Accounting in Steam Engine Works." By Fred. W. Child, accountant for H. R. Worthington. Address "The Office Company" Publishers, 37 College Place, N. Y.

MANUFACTURES

H. B. Tilden will build a stamp mill at Tyra, N. C.

C. C. Marshall is building a shovel handle factory at Oakland, Me.

The Crown Cotton Mill, of Dalton, Ga., contemplate adding new machinery.

The Hope Manufacturing Company are enlarging their cotton mill at Fayetteville, N. C.

The Hampden Foundry and Machine Company has been chartered at Clifton, W. Va.

The Marion Bullion Company are considering the erection of a stamp mill at Marion, N. C.

Baker & Whitmarsh will remove their shoe manufactory from Abington to Brockton, Mass., at once.

Lake Charles, La., wants a machine shop, and will offer inducements to good parties who will fill the want.

The Louisville and Nashville Railroad Company is considering the question of building repair shops at Bessemer, Ala.

The Cooper Manufacturing Company have purchased a site at Atlanta, Ga., upon which they will build a three-story factory.

A plumbing, gas fitting and machine shop will probably be started at Decatur, Ala. S. E. Eldridge, of Dwight, Ill., is interested.

The West Point (Ala.) Manufacturing Company propose to remove to Birmingham, Ala., where they will build a machine shop and foundry.

The Crosby Paper Company, of Marion, Ind., have built a mill for making straw wrapping paper, in which the fuel used will be natural gas.

By agreement with the citizens of Findlay, Ohio, the New York, Mahoning and Western Railroad must complete their shops at that place within a year.

The Real Estate Exchange, of Denver, Col., are anxious that some one shall build woolen mills at that place; prospects of success are said to be excellent.

A water power is offered free at Phillips, Maine, to any one who will establish a veneer factory. Lumber is abundant. Fred. S. Farmer, of Phillips, can give information.

The Washburn & Moen Manufacturing Company of Worcester, Mass., are making an addition 78x128 feet to their works, in order to introduce a new process for tempering wire.

Elwin Adams, Newburyport, Mass., has begun work in his shoe shop, employing about a dozen hands at first, and will gradually increase to a force of thirty-five hands. The power for use in this shop will be by electric motor, the first to be used in Newburyport.

A new company has been incorporated at Newark, Ohio, known as the Newark Novelty Manufacturing Company. The incorporators are James Henry, of Columbus; E. W. Parnell, E. J. Maurath, James S. Kuster, James Lingafelter, and T. O. Donovan, of Newark. The capital stock is $20,000. The company propose to manufacture small castings, wire goods, etc.

The new Pennsylvania Railroad shops at Pavonia, N. J. on the Camden and Amboy Division, are being pushed to completion as rapidly as possible. The car shop 135 x 265 feet, will be finished by the 1st of December, when it will be put in use immediately as a repair and paint shop. The building will have 14 tracks, with standing room for 28 cars.—*South Jersey Advertiser.*

The Galveston, Texas, Bagging and Cordage Company are pushing the construction of their big factory with all possible speed. The factory is located on Fortieth street, between Church and Winnie, and will be 300 feet long by 202 feet wide, and three stories high. It is to be built entirely of brick and stone. The first floor will be the largest single room in Texas.

P. H. & F. M. Roots, Connersville, Ind., think that the problem of piping natural gas any distance will be solved by Roots' positive blower and exhauster. The first exhauster will be placed on the pipe line at the point where the friction and the well pressure balance each other; and an exhauster will be placed at each successive point of equilibrium all along the line.

The Hubbard Tinning Company, of Hubbard, Ohio, and Hon. J. W. Russell, of West Middlesex, Pa., have decided to combine their capital and stock, including the tin mill at Hubbard and the foundry at West Middlesex, and operate a large foundry at Hubbard. For this purpose a stock company will be organized, and additional buildings will be built to the tin mill at Hubbard.

A. D. Cadman & Co., of the Duquesne Brass Works and Foundry (Pittsburgh) have been awarded the contract for fitting all the boilers of the H. C. Frick Coke Company (about forty) for burning natural gas. The gas will be furnished by the Southwest Gas Company, from their Grapeville wells, and it will be used by all the works from Mt. Pleasant to Leith.—*American Manufacturer.*

The Clyde River Paper Company, of West Derby, Vt., has been made a stock company, and are about organizing under the general law. The capital is to be fixed at $150,000. The company now owns the paper mill, the Bragg property just above, the outlets of Echo pond and Seymour lake, with the control of the water in all these natural reservoirs. They expect to increase the product of this mill, and to build new ones.

It is estimated that $100,000 has been expended in building operations at Sanford, Mass., since January 1. Sixty buildings have been erected, including public buildings, business blocks, and private dwellings. The Sanford Mills Company have just completed an addition to one of their factories, 102 x 104 feet, one story with monitor roof, and are now engaged in laying the foundation for a new structure of the same description to be 140 x 180 feet. The company now employ nearly 600 hands in the various departments.—*The Commercial Bulletin.*

The Kansas City Radiator and Iron Foundry Company have completed their arrangements to locate their works at Argentine, Kansas, and have begun the erection of works. The company has a cash capital of $200,000, and propose to manufacture the Askins radiator, an improved radiator and ventilator combined. This will form the bulk of its business. A general foundry business will be done, however. All sorts of building iron and the lighter articles of foundry manufacture will be turned out at the works. The plant will cover nearly two acres of ground and will consist of three large and a number of smaller buildings.

The *Times-Democrat* has the following: Some months ago a syndicate of Charleston capitalists purchased a large tract of land and unlimited water power on the Enoree river, in upper South Carolina. Yesterday the Secretary of State was applied to by this syndicate for a charter for the Enoree Manufacturing Company, which is to be started with a capital stock of $400,000. The object of the company is the manufacture of spinning, dyeing, printing and furnishing all kinds of goods made of wool and cotton. Such men as Francis J. Pelzer and W. A. Courtney are among the incorporators. This is a big enterprise for Charleston men. Cotton mills in this State have been paying recently and several new factories are projected.

The Chester (Pa.) *News* says: Business is picking up at Roach's shipyard in a gratifying manner to all concerned. A contract has just been closed with the Ocean Steamship Company for the construction of a new steamship to ply between New York and Savannah The vessel will be 320 feet long, 42 feet beam, and supplied with triple expansion engines of an improved type. A number of staterooms for passengers will be provided, although principally the steamer will be used to carry freight between the points named. Work upon the new craft has already been commenced in the mould loft. The firm are now negotiating for new contracts with the Mallory Steamship Company and also for two gunboat contracts. This morning lines were laid off for an enlargement of the punch shed.

A *Tribune* special from Fall River, Mass., says: The Flint Mill of this city has received an order for a miscellaneous lot of goods, consisting of print cloths, sheetings, and heavy goods for the Congo Free State in Africa. Some time ago a lot of goods were sent by two Fall River residents to be distributed by the missionaries among the natives. This benevolent act led to an early reward. The only cotton goods which reached that country heretofore were of English manufacture. The result of a comparison of the different grades was favorable to the American. In the English manufacture clay is used to a great extent for coloring, but it washes out and leaves a faded look upon the goods. The grades of American cotton were found to be better wearing than the English.

The Newark Machine Tool Works, East Newark, N. J., are building a gap lathe 40 feet long to swing 9 feet over shears, and 14 feet in gap by 4 feet long, for the North Chicago Rolling Mill Company. The main spindle bearing will be 16" x 20", and the tail spindle will be 8" x 4" of steel. The face plate will be 9 feet in diameter; the bed 7½ feet wide with triple shears. The lead screw weighs 2,000 pounds. The tool complete will weigh not far from 100,000 pounds. This is one of the largest tools ever constructed in New Jersey, if not the largest. It will be, it is said, the largest in the State of Illinois. The company have also sold to the Chicago firm a double head double column drill, to take in work 10 feet high by 12 feet wide. These tools are for the shops now in course of erection at South Chicago. They have also orders for large tools for the Cleveland City Forge and Iron Company, and for other firms.

Machinists' Supplies and Iron.

NEW YORK, Nov. 17, 1887.

Iron—American Pig—The market has developed no new or interesting feature, business remaining generally quiet. The purchases of consumers are still of a hand-to-mouth character, and buyers still complain of difficulty in obtaining prompt deliveries of Lehigh Foundry brands, but other brands are abundant and readily available at slight concessions from quoted prices. The feeling is still unsettled and prices are irregular. Standard and Le, high brands of No. 1 X Foundry are held at $21 to $21.50, but other brands can be bought as low as $20.50. No. 2 Foundry ranges from $18.50 up to $19.25, and Grey Forge is in abundant supply at $16.50 to $17.25, with some common kinds quoted as low as $15.75.

Tin—We quote Straits and Malacca 22¼c. cash, and 32½c. 30 days; Australian, 31c. cash, 31½c. 30 days.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

A young man who is a good machinist and draftsman would like employment with opportunity to travel. Address Box 72, AM. MACHINIST.

Draftsman—College graduate with some practical experience in machinery details wants position; salary no object. Correct, AM. MACHINIST.

Wanted—Situation as foreman of boiler shop; 15 years' experience, sober and familiar with shop accounts; best references. G. S. O., AM. MACHINIST.

An efficient mechanical draftsman on small steam engines and light hardware in general, desires a situation. Address D. W. M., 348 W. 22nd st., N. Y. C.

Wanted—a blacksmith, experienced in drop and machine forging, to take charge. Address, stating experience and wages expected, Foreman, Box 64, AM. MACHINIST.

Wanted—A good machinist and draftsman, young man preferred; competent to control and manage large number of men. Address N. R. Marvin, 212 Pacific ave., Jersey City, N. J.

A young man actually employed in a machine shop would like to find, by Spring, situation as apprentice in reliable shop to thoroughly learn the trade. X. Y. Z., AM. MACHINIST.

Situation wanted by first-class patternmaker and draftsman on rolling mill and general work; 16 years' experience, past 5 years in charge; best references. P. D. C., AM. MACHINIST.

Wanted—Two first-class patternmakers at once; prefer those that are accustomed to power transmission of all kinds with the exception of gearing. The Falls Rivet Co., Cuyahoga Falls, O.

Wanted—Position as superintendent or foreman by a young man who has held the same for a number of years on fine tools, interchangeable work and automatic machinery. Best of references. W. H. S., 1331 So. 16th st., Phila., Pa.

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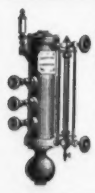

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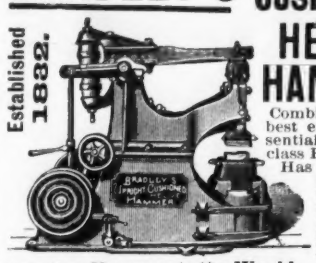

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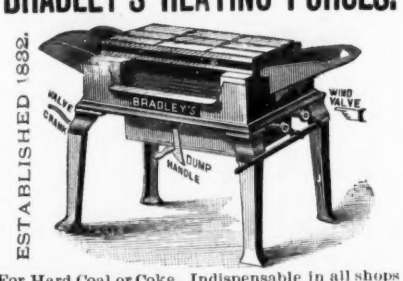

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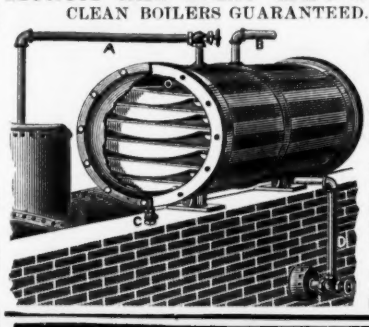

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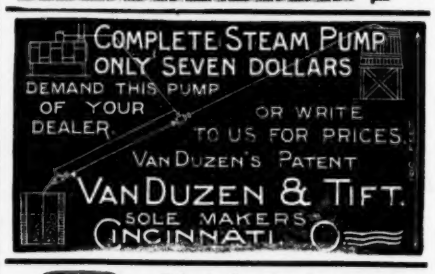

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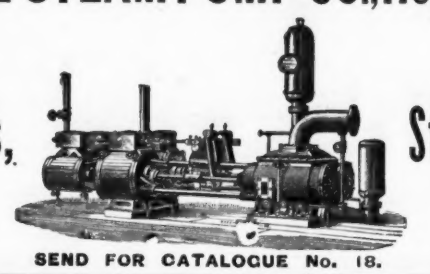

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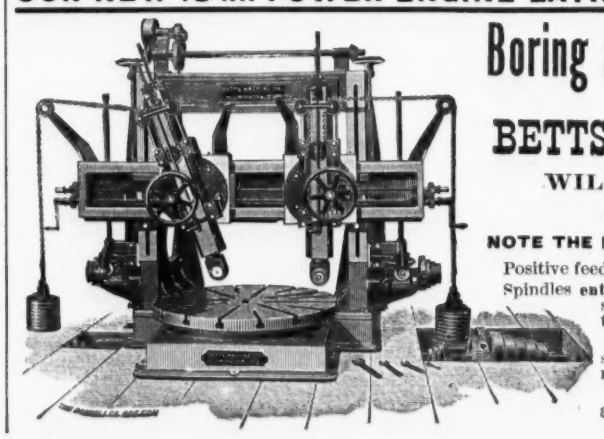

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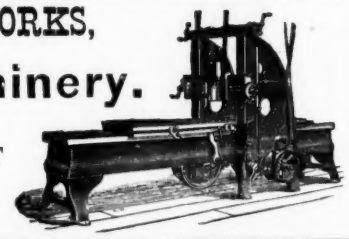

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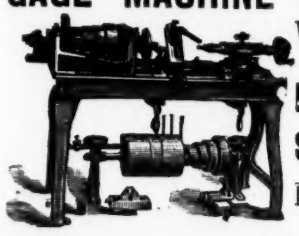

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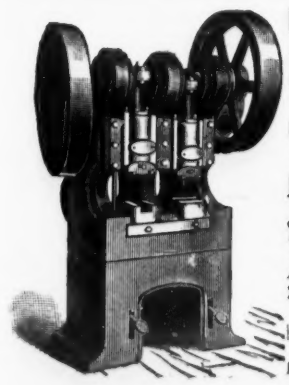

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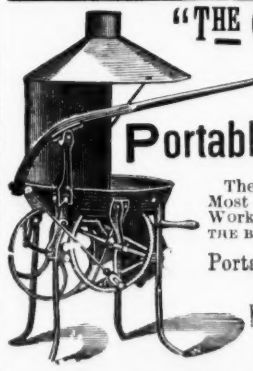

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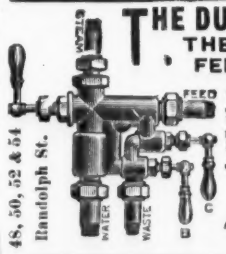

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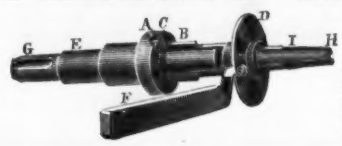

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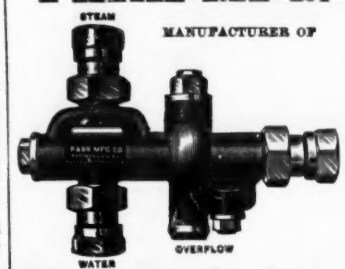

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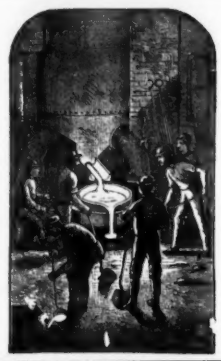

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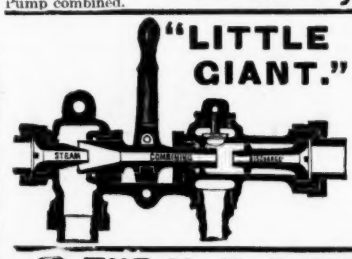

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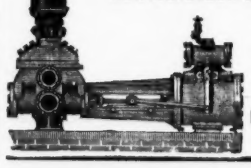

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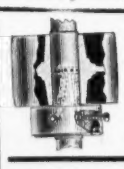

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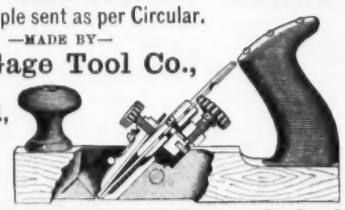

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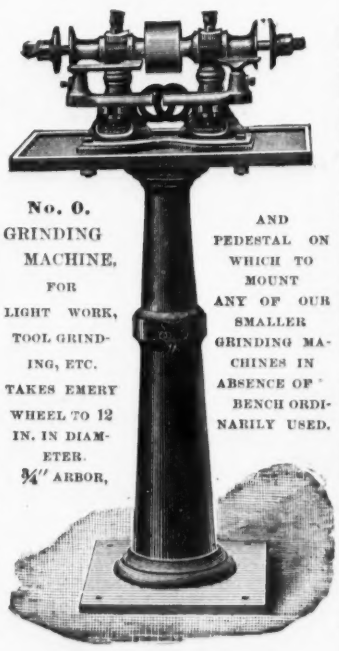

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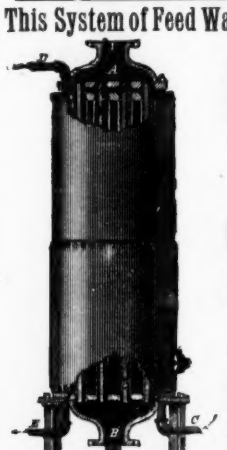

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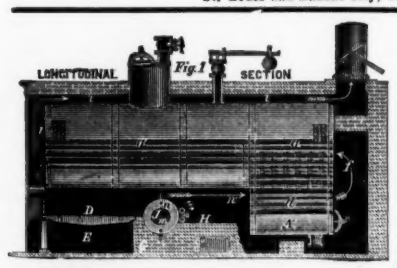

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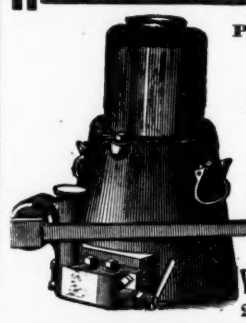

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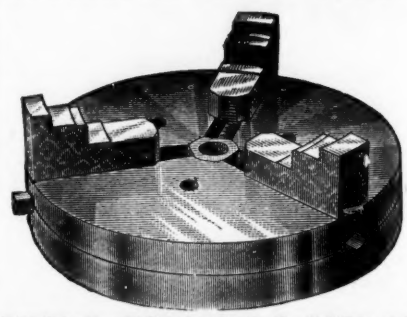

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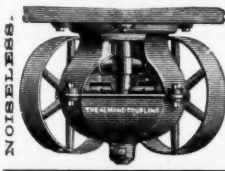

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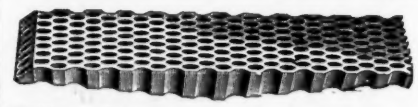

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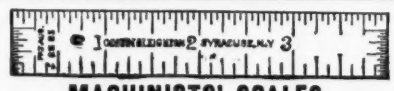

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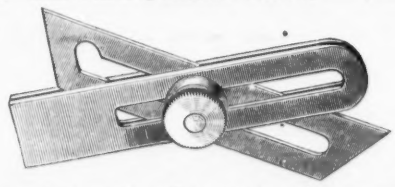

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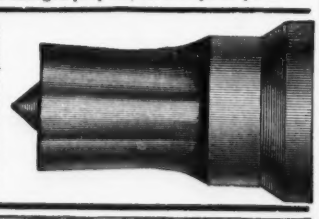

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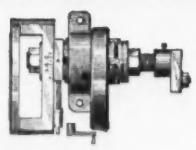

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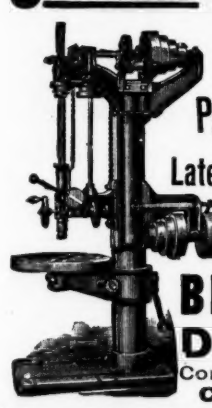

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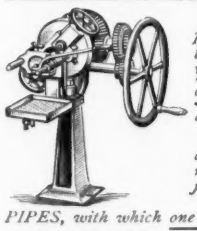

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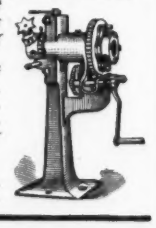

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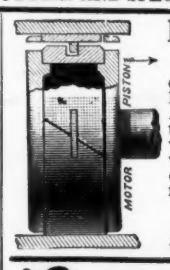

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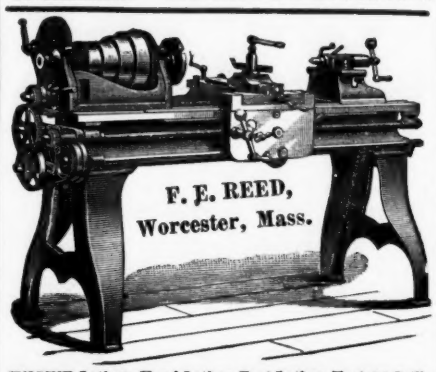

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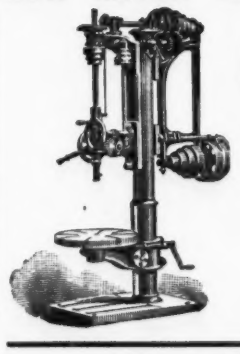

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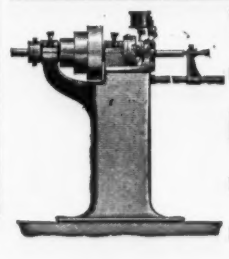

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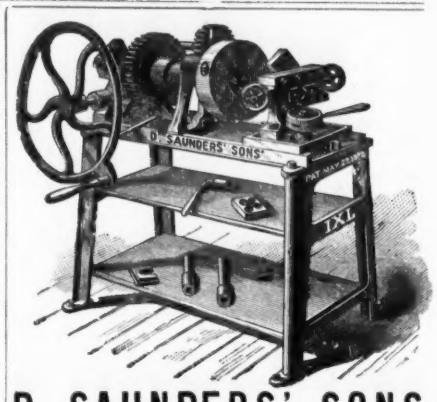

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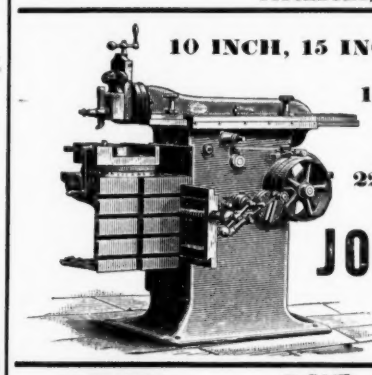

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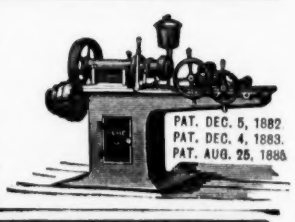

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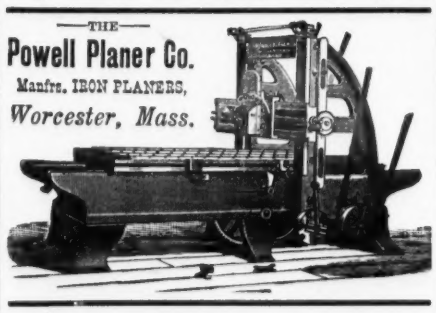

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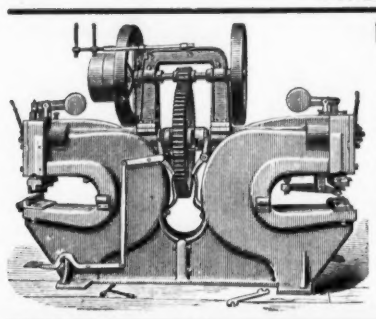

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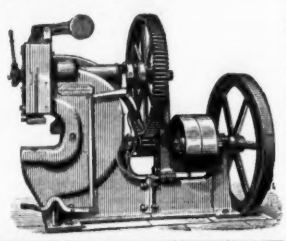
Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven



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16" ENGINE LATHES.

FIRST CLASS WORKMANSHIP.
ACCURATELY AND SUBSTANTIALLY BUILT,
WITH OR WITHOUT COMPOUND REST AND TAPER ATTACHMENT.
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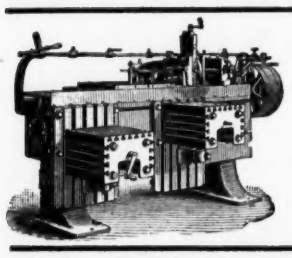

Defiance Machine Works, Defiance, Ohio, April 16, 1886.

E. A. WALKER, 75 Laurel St., Philadelphia, Pa.

Dear Sir:—In answer to your enquiry as to how we now like the "Richards Combination Planer and Shaper," we must say that we are loth to write the truth from fear of appearing extravagant. All that we could say in its favor would be far less than it deserves. During the three years in which it has been continually in use, it has become more and more a favorite with all our mechanics. From the time we set it running we have considered it indispensable. Its easy adaptability to a wide range of large work enables it to take the place of large and expensive planers, and thus its economy is abundantly proved. Its availability for very fine work also can hardly be surpassed.

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Embraces nearly 400 Machines for

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WOOD WORKERS.

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NEW STYLES.
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The spindles in these drills are driven with a single belt made endless, no lacing, and tightener pulleys for adjusting tension provided. No more trouble from slack belts, slippage, uneven motion from lacings, or time lost taking up belts.

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and superior to any multiple spindle drill made for drilling from .004 to 3-8 inch holes. Single Spindle Drills improved. Over 800 in use. Send for catalogue.

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In machine shops south and west of Penn. Outfit free. Samples 10c.

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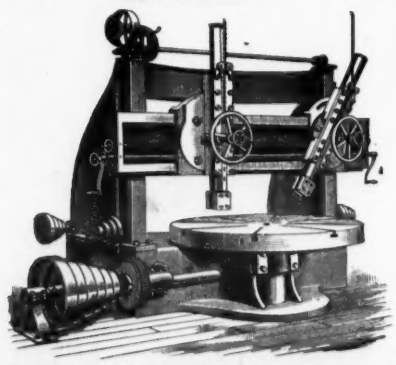

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Superior Design & Workmanship, Extra Heavy (1500 lbs.)
DOWN, ANGULAR AND CROSS-FEED,
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Two 48" x 48" x any desired travel.

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The above are held at very **Low Prices.**

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The Open Side Iron Planers.

Adapted for all classes of Machine Work, and especially for a large amount of the EXTRA WIDE and HEAVY WORK necessitating the Large and Costly Planers of the regular style.

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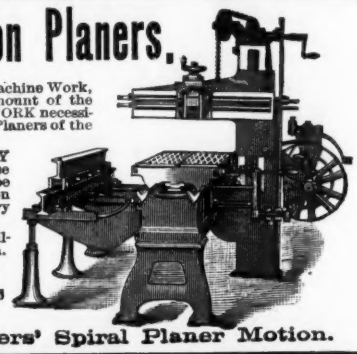

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Non-Condensing,
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40 TO 1,000 H.P.

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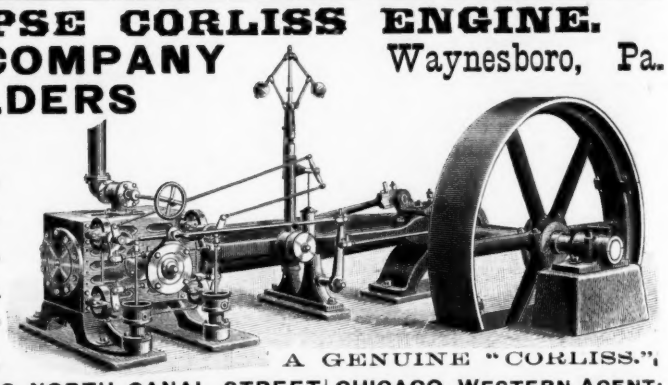

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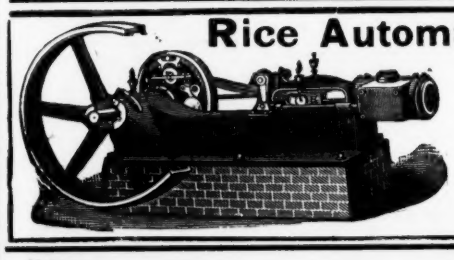

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Balanced Valve. High Speeds.
Stationary Oilers. Best Economy.

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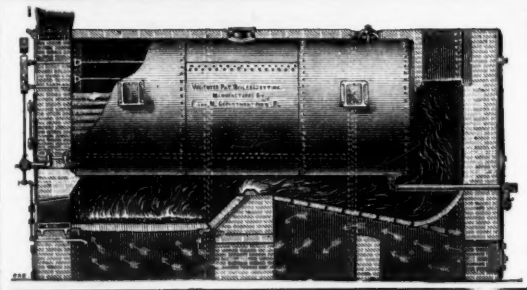

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12 Sizes.
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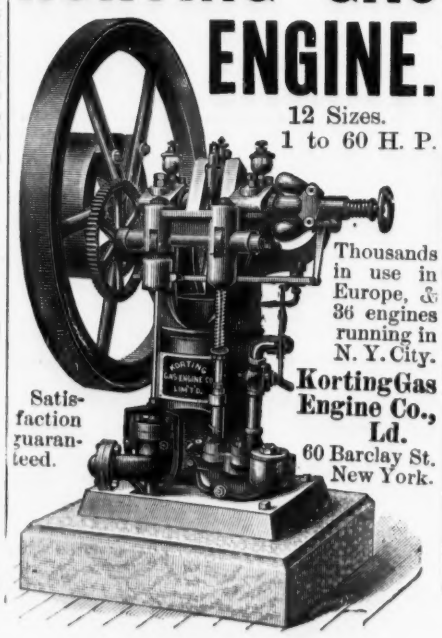

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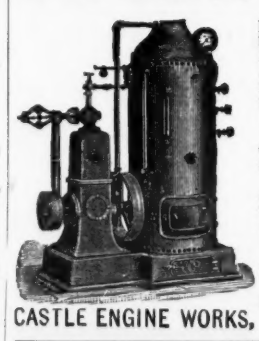

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One and Two Cylinder Engines for Launch and other purposes.

Vertical, Horizontal and Porcupine Boilers, with Supplies. Low Prices. 1 to 15 H. P.

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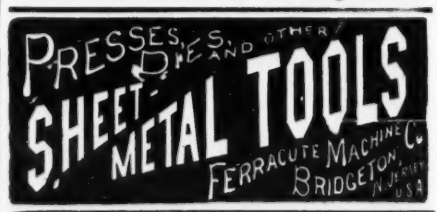

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			Second Hand.
One 70 H. P.	Stationary	Boiler	" "
" 60 H. P.	"	"	" "
" 50 H. P.	"	"	" "
Two 40 H. P.	"	"	" "
One 30 H. P.	Vertical	"	" "
Two 15 H. P.	"	"	" "
One 40 H. P.	Portable	Engine	" "
" 30 H. P.	"	"	" "
" 8 H. P.	"	"	" "
" 60 H. P.	Stationary	"	" "
" 20 H. P.	"	"	" "
" 20 H. P.	Vertical	"	" "
Two 12 H. P.	"	"	" "
One Surface Planer, 27" wide,			" "
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New and Second Hand Shafting, Hangers, Pulleys and Belting.

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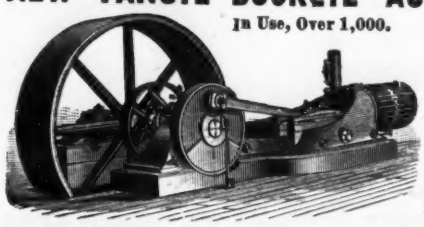

These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 100 H P for driving Dynamo Machines *a specialty*. Illustrated Circulars, with various data as to practical Steam Engine construction and performance, free by mail. **Address, BUCKEYE ENGINE CO., Salem, Ohio.**

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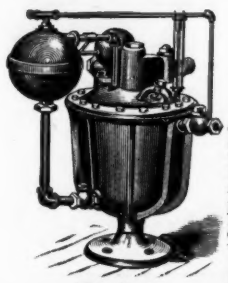

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Automatically drain the water of condensation from **HEATING COILS** and return it to the boilers, whether the coils are **above** or **below** the water level in boiler, doing away with pumps and other mechanical devices for such purposes. Send also for Circulars of **Blessing's Renewable-Seat Stop and Check Valves, Pump Governors, and Water Circulator and Purifier.**

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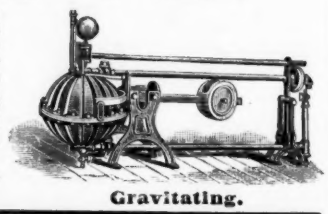
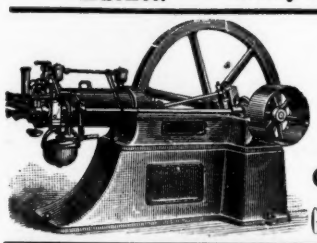


Gravitating.



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16-20 in. x6-8-10 & 12 ft.		Bridgeport,	new.
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18 in. x8 ft.	"	Blaisdell,	"
20 in x 12 ft.	Eng. Lathe	Ames,	A 1.
24 in. x10 14 & 20 ft.	"	Ames,	"
25 in. x- 12 & 14 1-2 ft.	"	Bridgeport,	"
26 in. x16 ft.	"	New Haven,	good order.
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No. 5 Screw Machine.		Jones & Lamson.	
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Merrill Drops, 800 lbs.			good order.
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Milling Machines, Screw Machines, Slate Sensitive Drills, Gang Drills, and full line of all kinds of Machine Tools. Send for list and specify what is wanted.

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We are now making from entirely new designs, *extra heavy* 17", 19", 21", 24" and 27" Engine Lathes (the most popular sizes), of which we are making a specialty, and manufacturing in lots of not less than 100 at a time.

We make no charge for extras. Every lathe is furnished with *hollow spindle*; the 19" with 1⅝" hole, and 21' with 1⅞" hole. Every lathe has substantial *compound rest*, heavy tool post (bar steel), rest to turn full swing, *following rest* with adjustable jaws to take any size from 2½" down, with extra tool for shafting. Full set of gears to cut from 2 to 18 threads including 11½ pipe thread. *Automatic stop on carriage. Separate screw and rod feed,* and the most substantial and easily managed *taper attachment* made. Cones and gears of large diameter and wide belt. Studs, screws and small gears are *steel or gunmetal.* Webbed live heads, heavy tail stocks. No worm or worm gears, no weak reverse plate. *Perfect lubrication for all running parts,* including carriage.

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We guarantee this lathe to be equal in workmanship, truth, accuracy, solidity, material and finish, to the best made, and hold ourselves legally liable for this guarantee.

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MANUFACTURERS OF IMPROVED CORLISS STEAM ENGINES IN FULL VARIETY.

Sizes Varying from **30 to 2000 Horse Power.**

Horizontal or Vertical, Direct Acting or Beam, Condensing, Non-Condensing or Compound.

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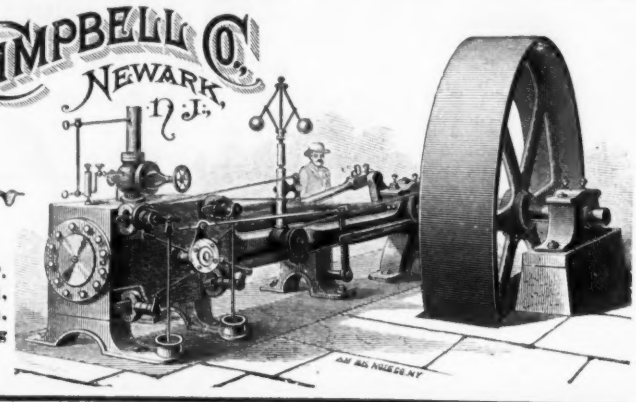

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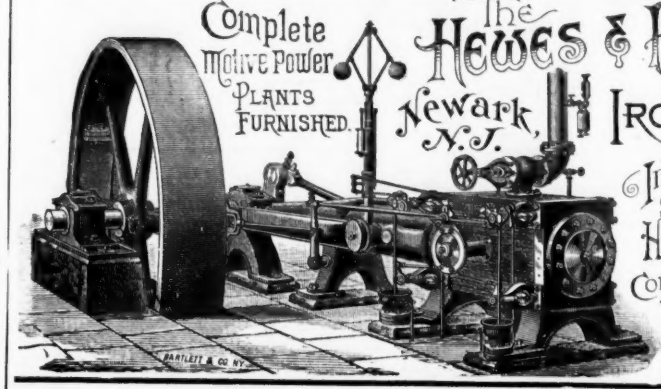

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BUILT BY THE FISHKILL LANDING MACHINE CO.,

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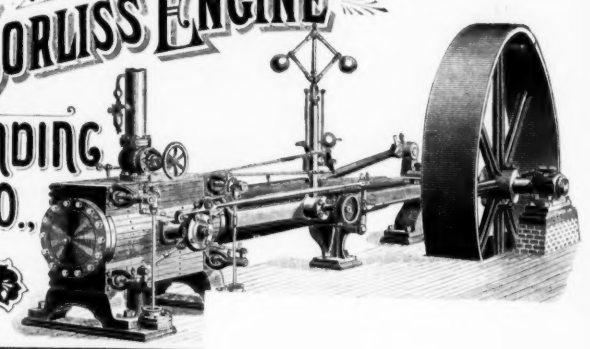

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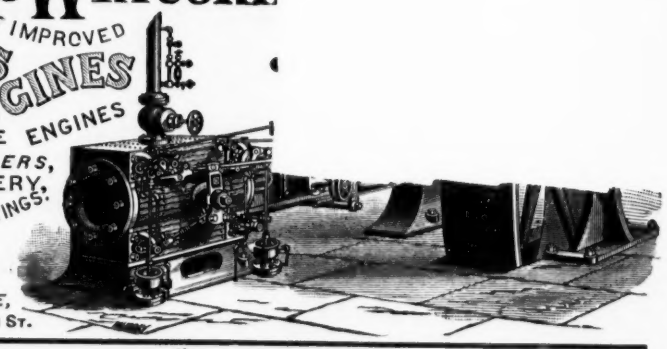

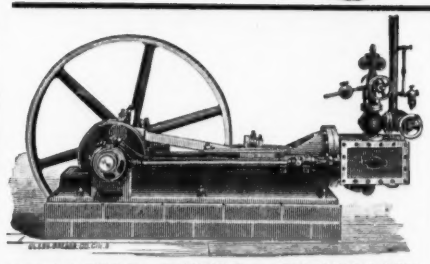

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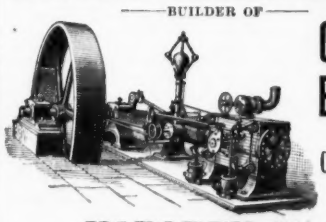

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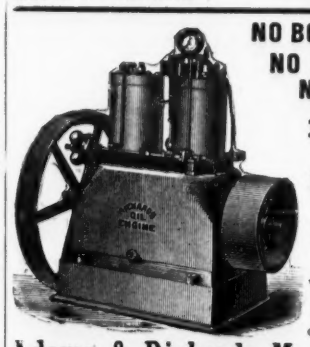

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FUEL, CRUDE PETROLEUM OR KEROSENE.

Started instantly with a match.

Cheaper than all others.

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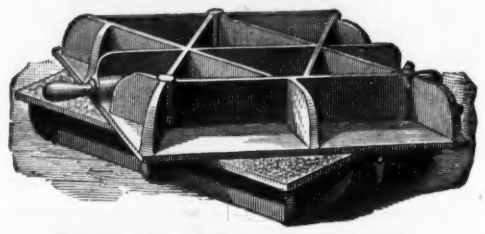

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4½ in. x 6 in.	9 in. x 9 in.	12 in. x 12 in.	16 in. x 16 in.
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6½ in. x 18 in.	10 in. x 30 in.	14 in. x 18 in.	24 in. x 24 in.
	36 in. x 66 in.		

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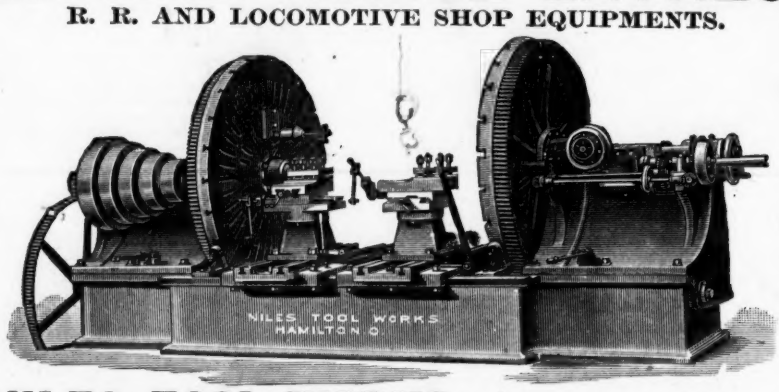

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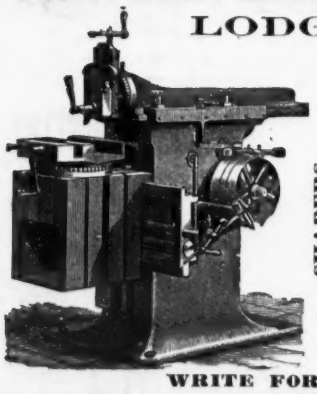

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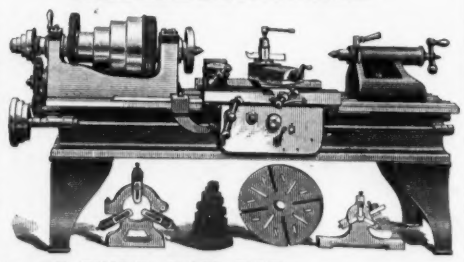

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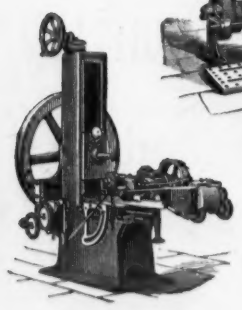

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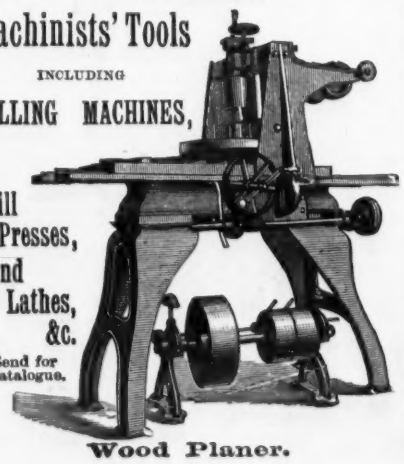

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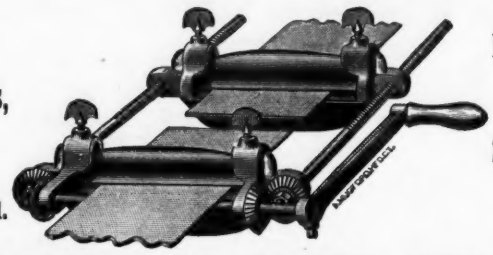

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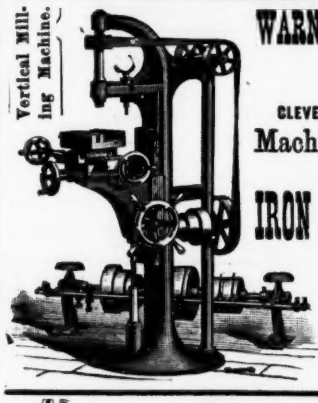

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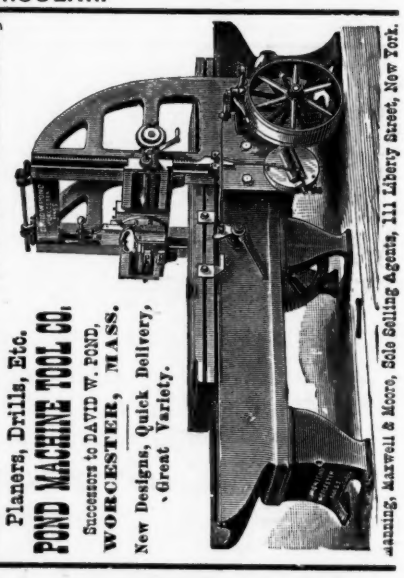

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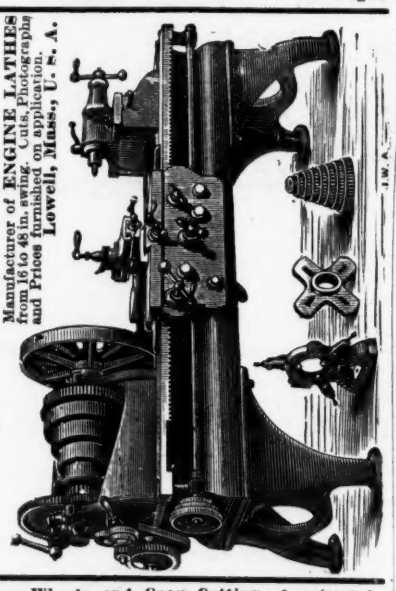

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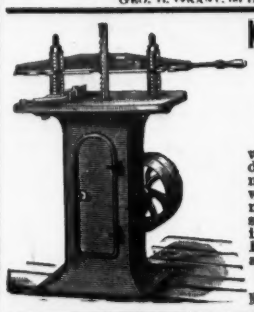

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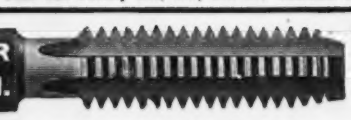

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